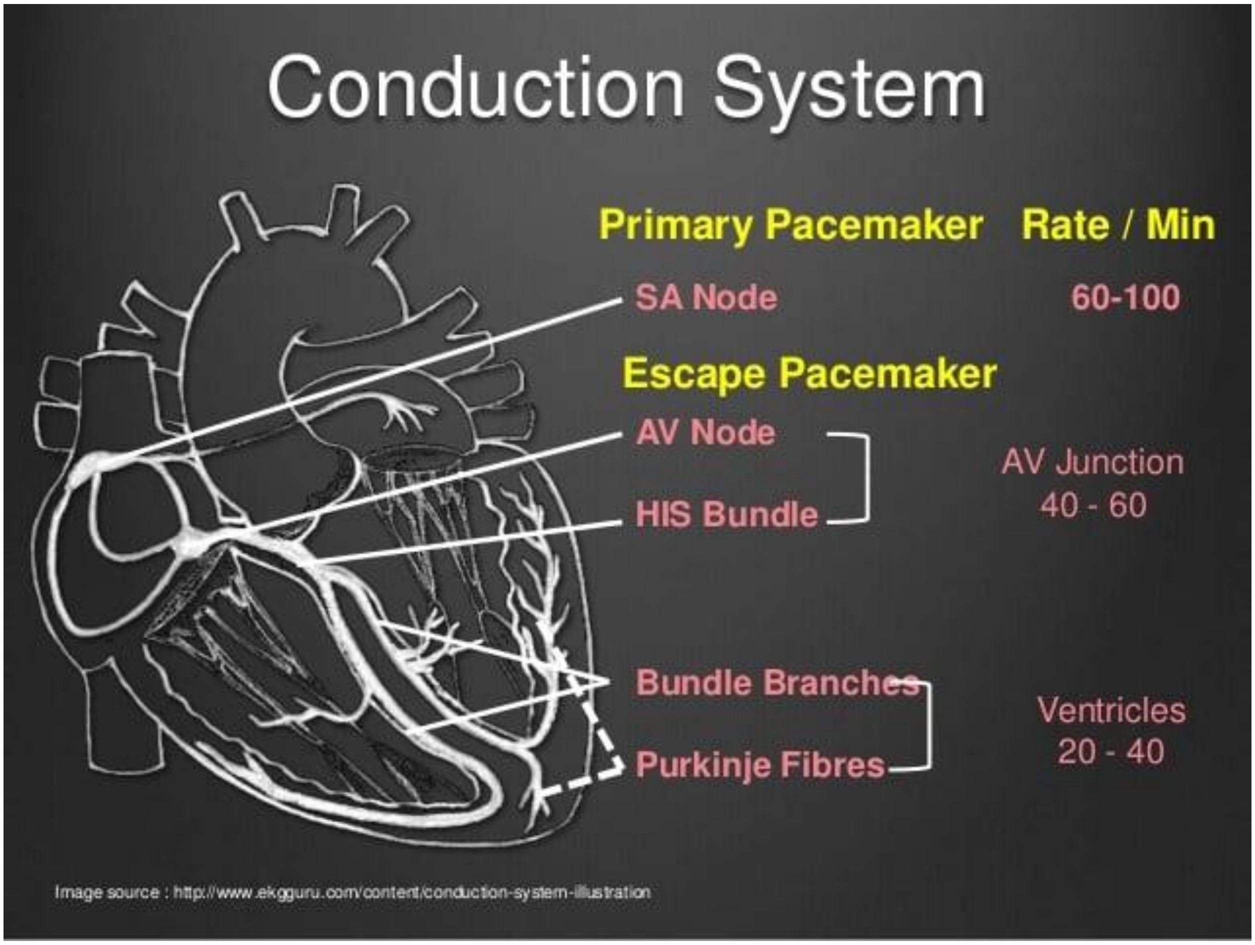
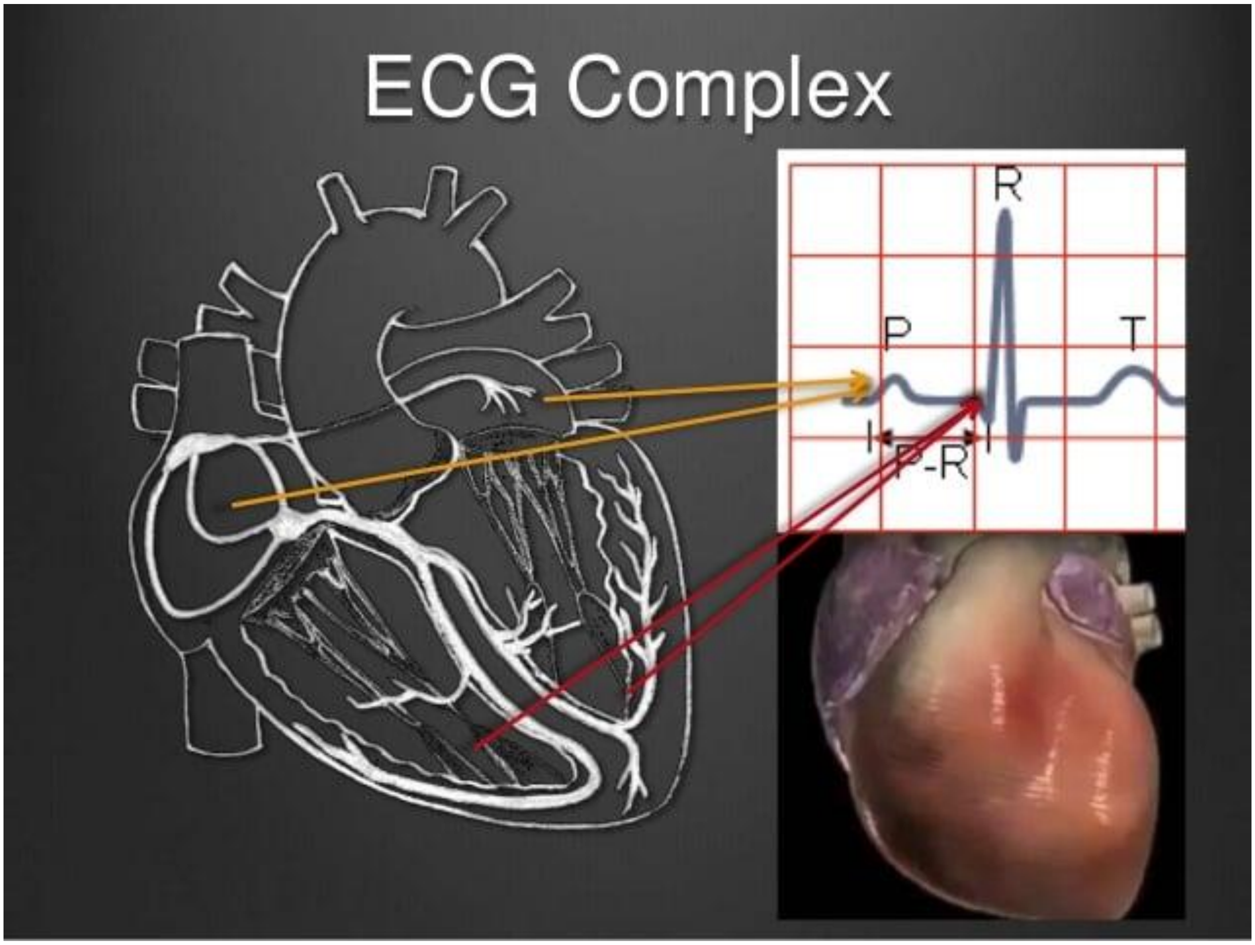
ECG Report

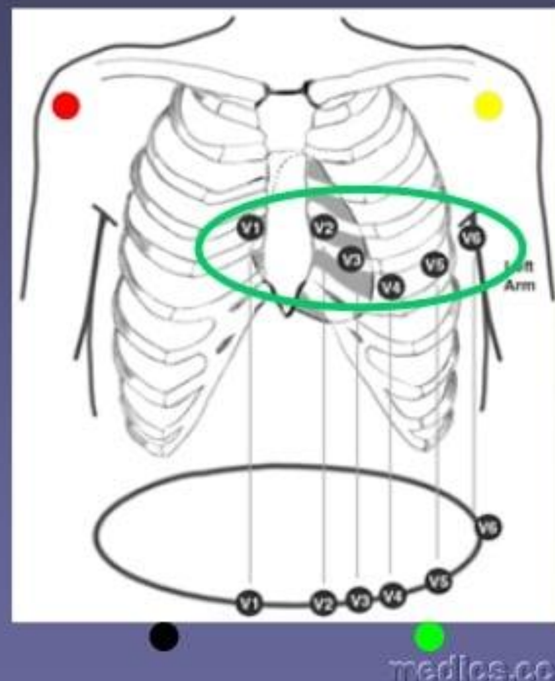
DrHaitham Fahmey


Conduction System
Primary Pacemaker
Rate / Min
SA Node
60-100
Escape Pacemaker
AV Node
HIS Bundle
AV Junction
40 - 60
Bundle Branches
Purkinje Fibres
Ventricles
20 - 40
Image source : http://www.ekgguru.com/content/conduction-system-illustration


ECG Complex
R
P
T
P-R

Electrode placement in 12 lead ECG

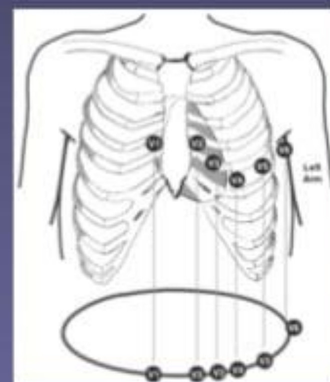
- 6 are chest electrodes
  - Called V1-6 or C1-6
- 4 are limb electrodes
  - **Right arm** **R**ide
  - **Left arm** **Y**our
  - **Left leg** **G**reen
  - **Right leg** **B**ike
  - Remember
    - The right leg electrode is a neutral or "dummy"!



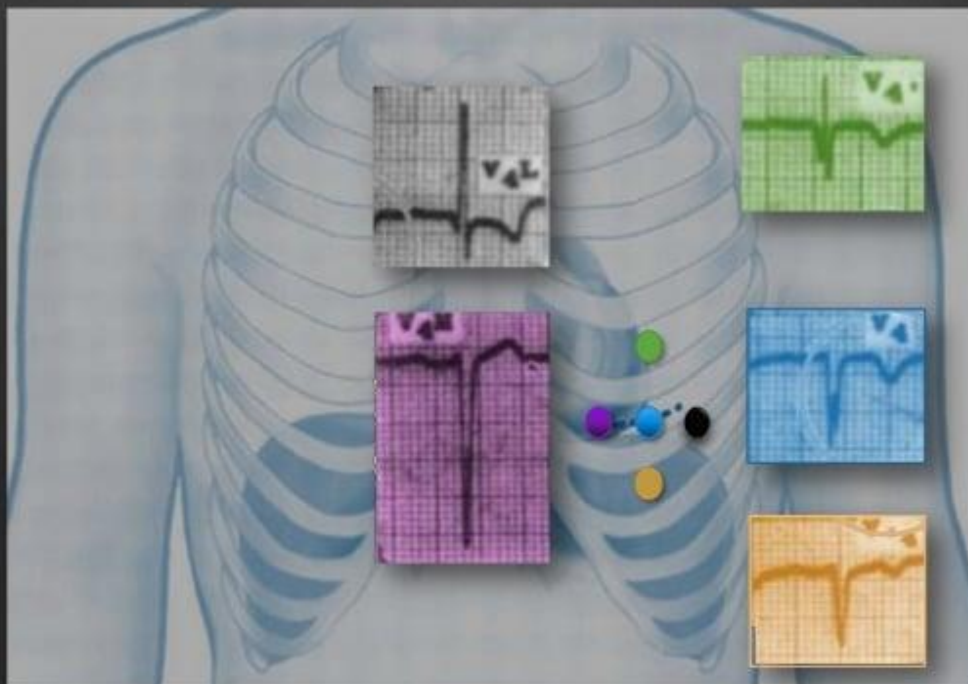
Electrode placement

For the chest electrodes

- V1 4^{th} intercostal space right sternal edge
- V2 4^{th} intercostal space left sternal edge
  - (to find the 4^{th} space, palpate the manubriosternal angle (of Louis)
  - Directly adjacent is the 2^{nd} rib, with the 2^{nd} intercostal space directly below. Palpate inferiorly to find the 3^{rd} and then 4^{th} space
- V4 over the apex (5^{th} ICS mid-clavicular line)
- V3 halfway between V2 and V4
- V5 at the same level as V4 but on the anterior axillary line
- V6 at the same level as V4 and V5 but on the mid-axillary line



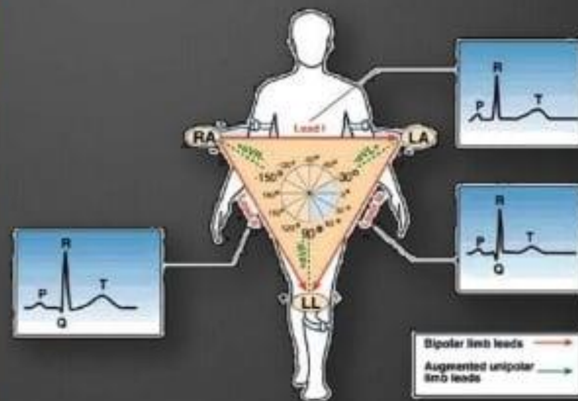
Lead Misplacement



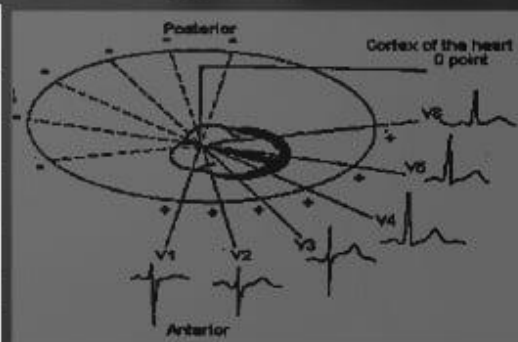
QRS-T changes secondary to shift of the V4 electrode

Standard Morphologies

Lead	P-Wave	QRS	T-Wave
Limb Leads – Vertical Plane			
I	↑	↑	↑
II	↑	↑	↑
III	↑	↑	↑
Augmented Leads			
aVR	↓	↓	↑↓
aVF	↑	↑	↑



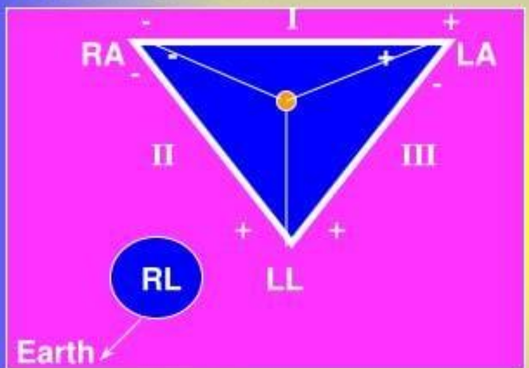
Lead	P-Wave	QRS	T-Wave
Precordial Leads – Horizontal Plane			
V1	↑/±	Small R wave / QS	↑
V2	↑/±	Small R wave / QS	↑
V3	↑	Equiphasic QRS / ↑	↑
V4	↑	↑	↑
V5	↑	↑	↑

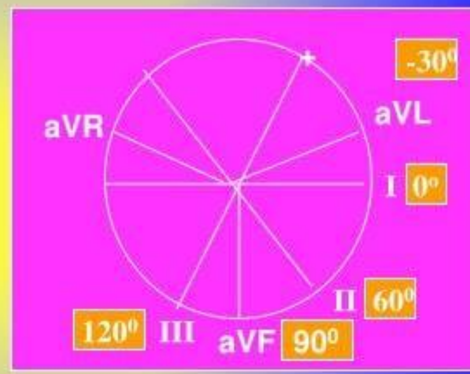


STANDARD LIMB LEADS

25. Recorded by placing (+) electrodes
in Right Arm (RA), Left Arm (LA), Left Leg (LL)

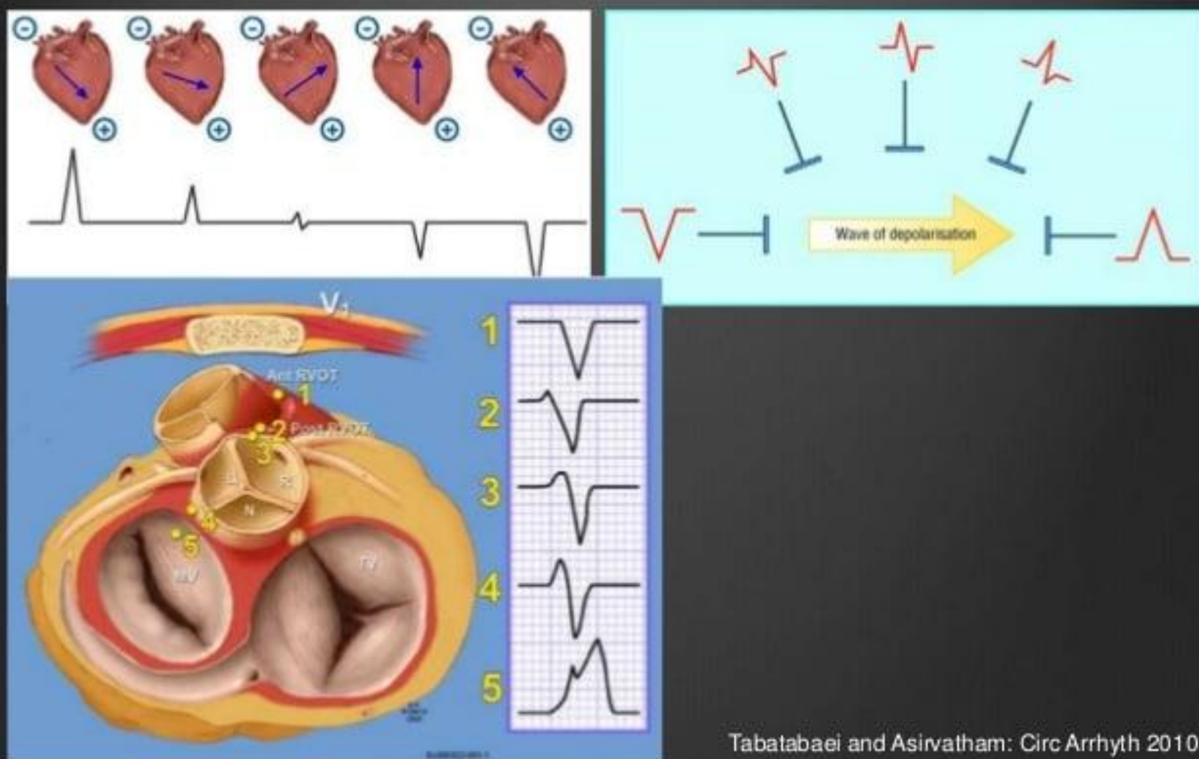
26. Recording ECG with



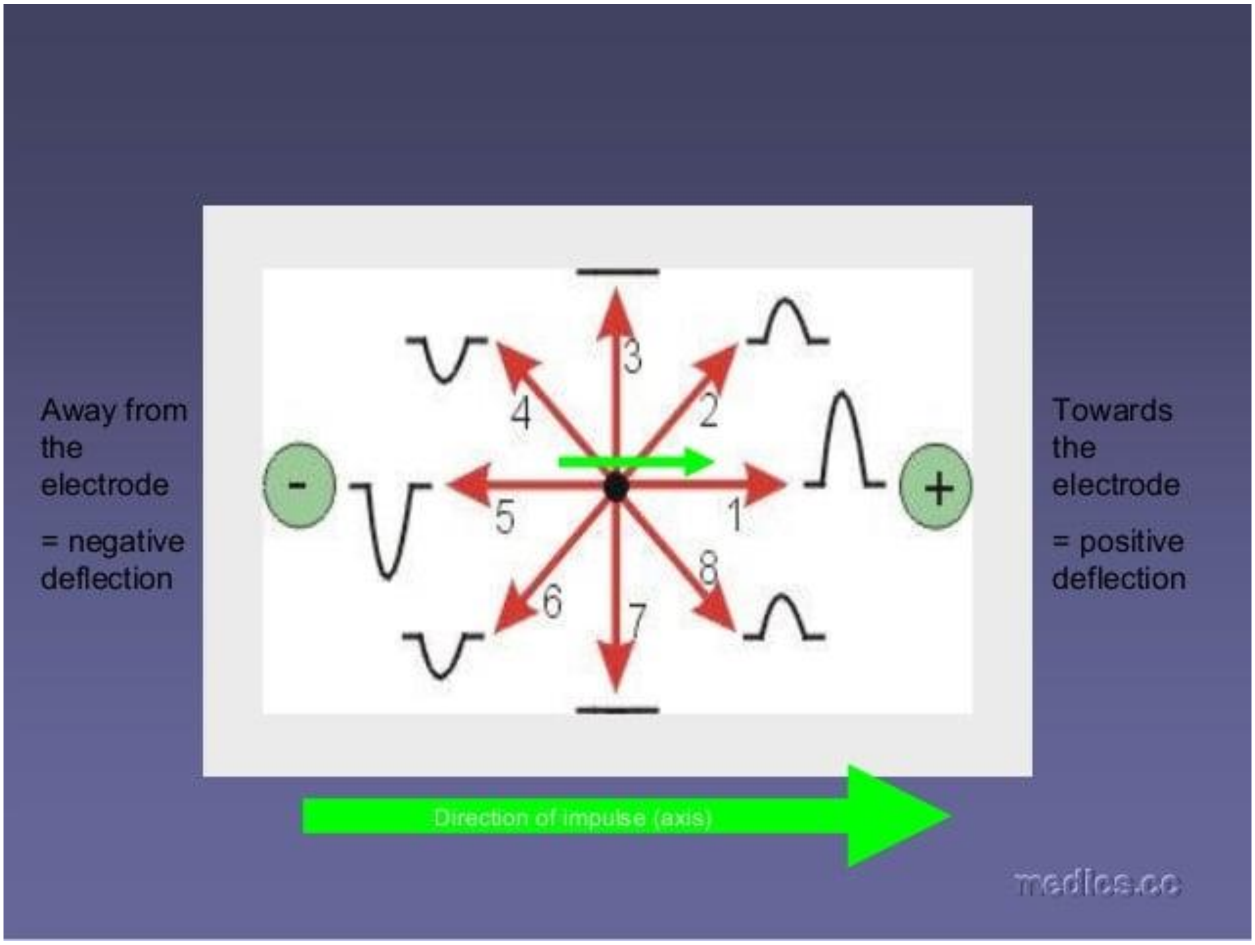


27. Positive electrodes placed in LA and LL why ?
Because current moving towards
a + electrodes produces a + deflection.
And that is what we want.

Depolarisation



Tabatabaei and Asirvatham: Circ Arrhyth 2010


Away from the electrode
= negative deflection
Towards the electrode
= positive deflection
-
+
1
2
3
4
5
6
7
8
Direction of impulse (axis)
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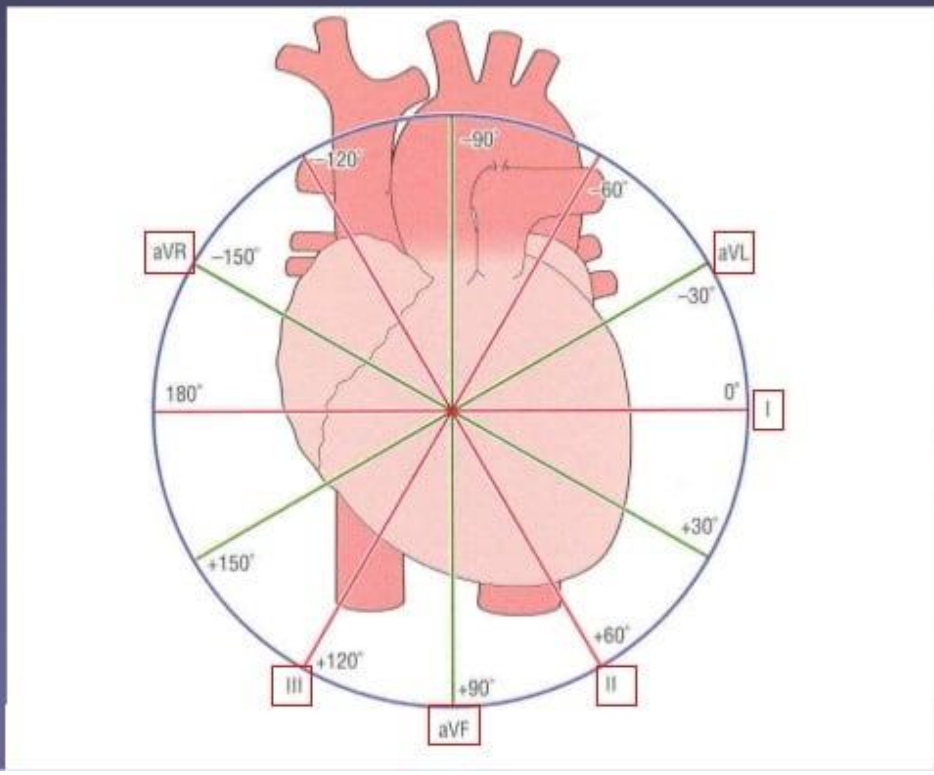
Types of Leads

- Coronal plane (Limb Leads)
  1. Bipolar leads — I , II , III
  2. Unipolar leads — aVL , aVR , aVF
- Transverse plane
  V_1 — V_6 (Chest Leads)

Electrodes around the heart



Lead Groups

- Inferior Leads
  - II, III, aVF
  - View from Left Leg ⊖
  - Inferior wall of left ventricle

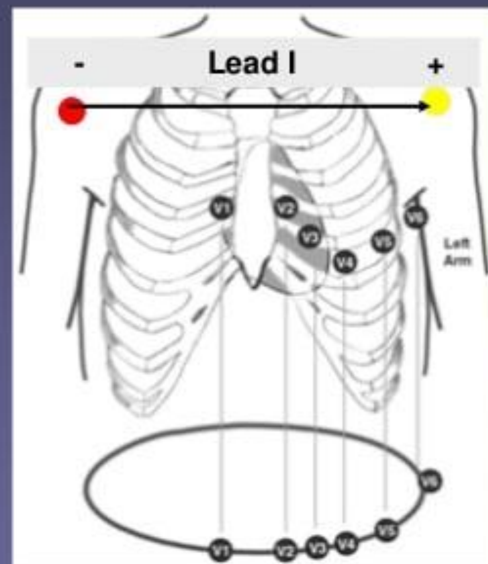
- Lateral Leads
  - I, aVL, V5 and V6
  - View from Left Arm ⊕
  - Left lateral chest wall / ventricle

- Anterior Leads
  - V3, V4
  - Left anterior chest
  - ⊖ electrode on anterior chest

- Septal Leads
  - V1, V2
  - Along sternal borders
  - Look through right ventricle & see septal wall

Leads

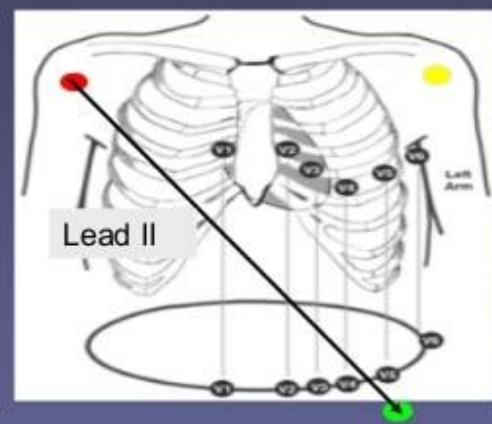
How are the 12 leads on the ECG (I, II, III, aVL, aVF, aVR, V1 – 6) formed using only 9 electrodes (and a neutral)?

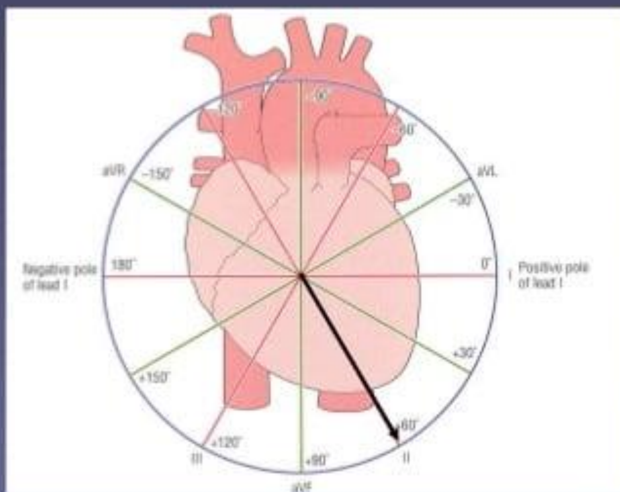


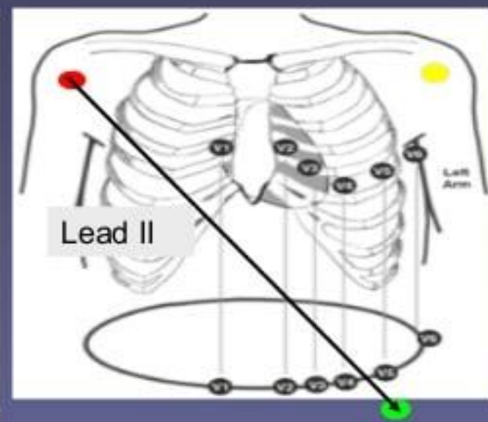
- Lead I is formed using the right arm electrode (red) as the negative electrode and the left arm (yellow) electrode as the positive

Leads

- Lead II is formed using the right arm electrode (red) as the negative electrode and the left leg electrode as the positive




aVR
−150°
aVL
−30°
Negative pole of lead I
180°
0°
I
Positive pole of lead I
+30°
+150°
+60°
+120°
III
+90°
II
aVF


Lead II
V1
V2
V3
V4
V5
V6
Left Arm

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Leads

- Lead III is formed using the left arm electrode as the negative electrode and the left leg electrode as the positive

- aVL, aVF, and aVR are *composite leads*, computed using the information from the other leads

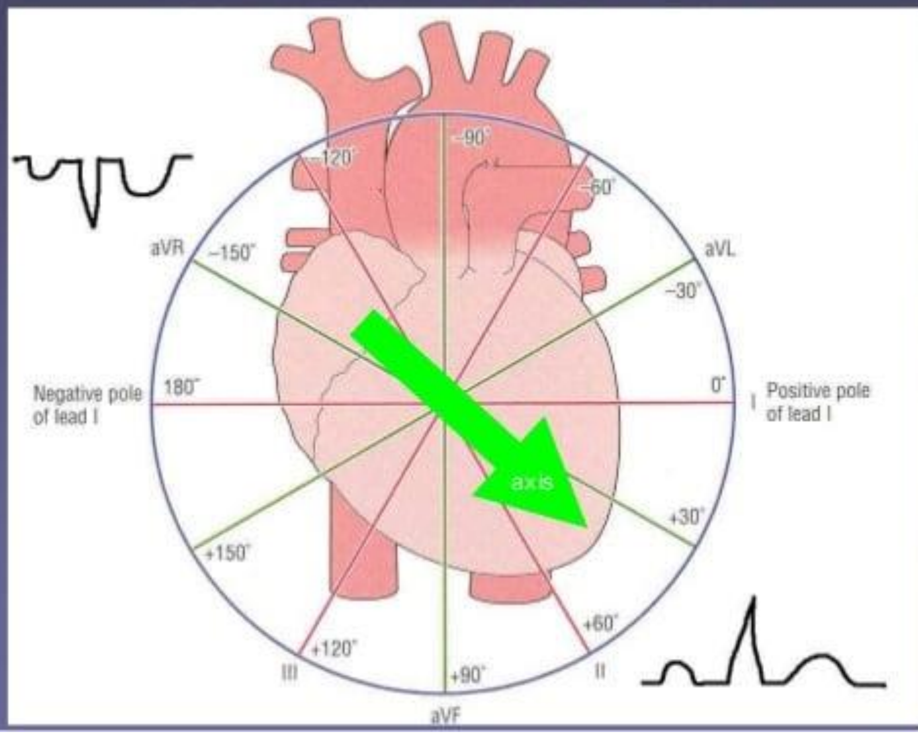
Leads and what they tell you

Limb leads

Limb leads look at the heart in the coronal plane

- aVL, I and II = lateral
- II, III and aVF = inferior
- aVR = right side of the heart

Leads look at the heart from different directions



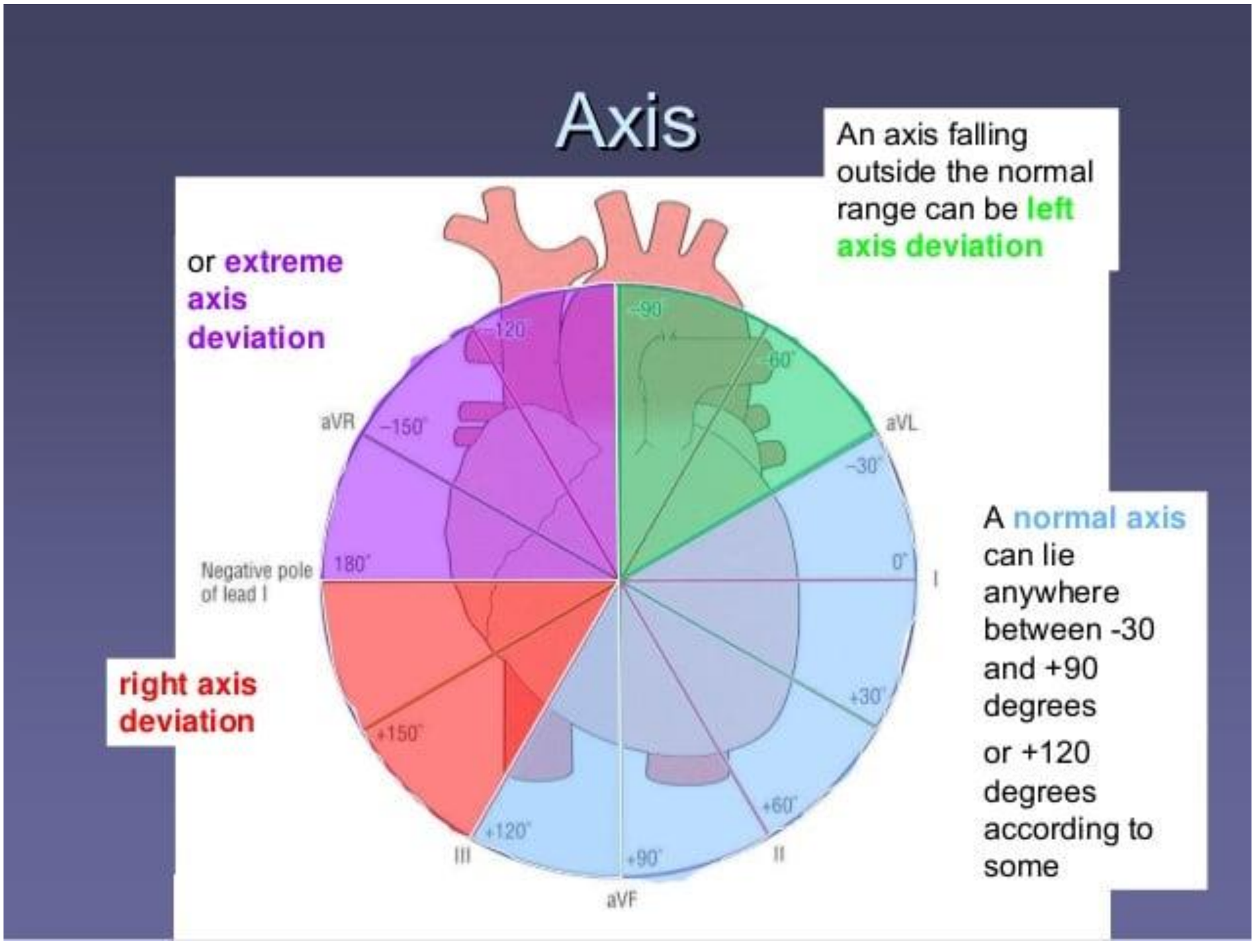
Leads and what they tell you

Each lead can be thought of as ‘looking at’ an area of myocardium

Chest leads

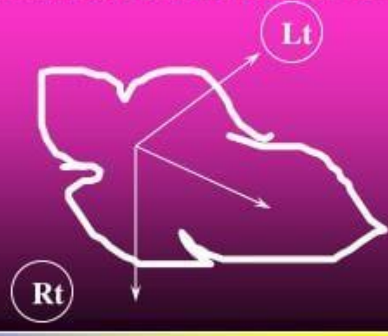
V_1 to V_6 ‘look’ at the heart on the transverse plain

- V_1 and V_2 look at the anterior of the heart and R ventricle
- V_3 and V_4 = anterior and septal
- V_5 and V_6 = lateral and left ventricle


Axis
An axis falling outside the normal range can be left axis deviation
or extreme axis deviation
right axis deviation
A normal axis can lie anywhere between -30 and +90 degrees
or +120 degrees according to some
aVR
aVL
Negative pole of lead I
I
II
III
aVF
−90°
−120°
−60°
−150°
−30°
180°
0°
+30°
+150°
+60°
+120°
+90°

IV AXIS:

61. Axis - means electrical axis of heart

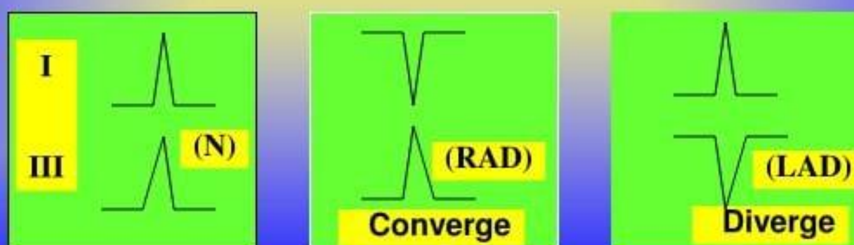


- Normal
- Rt axis deviation
- Lt axis deviation

62. Determination of axis - Crude but simple method study lead I and III alone

Net -ve

63.



Axis deviation - Causes

- Wolff-Parkinson-White syndrome can cause both Left and Right axis deviation

A useful mnemonic:

- "RAD RALPH the LAD from VILLA"

- **Right Axis Deviation**

- Right ventricular hypertrophy
- Anterolateral MI
- Left Posterior Hemiblock

- **Left Axis Deviation**

- Ventricular tachycardia
- Inferior MI
- Left ventricular hypertrophy
- Left Anterior hemiblock

ECG Interpretation

- Step 1: What is the rate?
- Step 2: Is the rhythm regular or irregular?
- Step 3: Is the P wave normal?
- Step 4: P-R Interval/relationship?
- Step 5: Normal QRS complex?

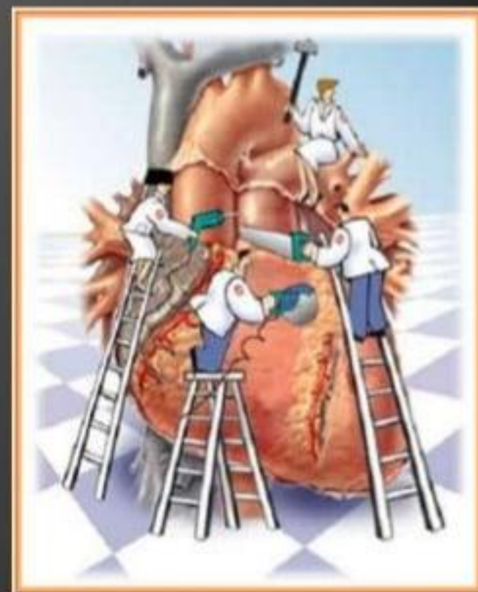


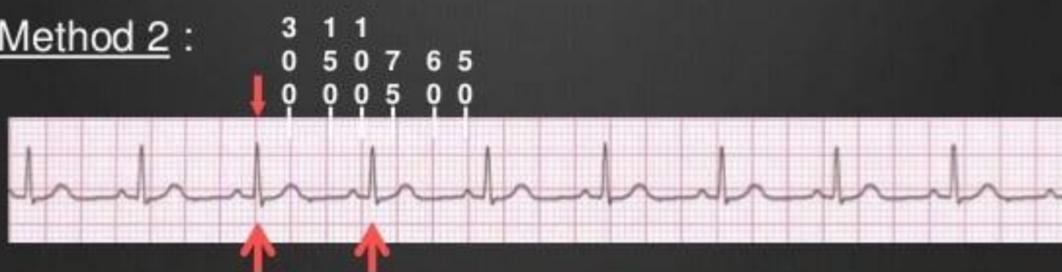
Image source : www.broward.edu/cehealth

Step 1 : Rate

<u>Method 1</u> : Count the number of R waves for a six second interval and multiply by ten.

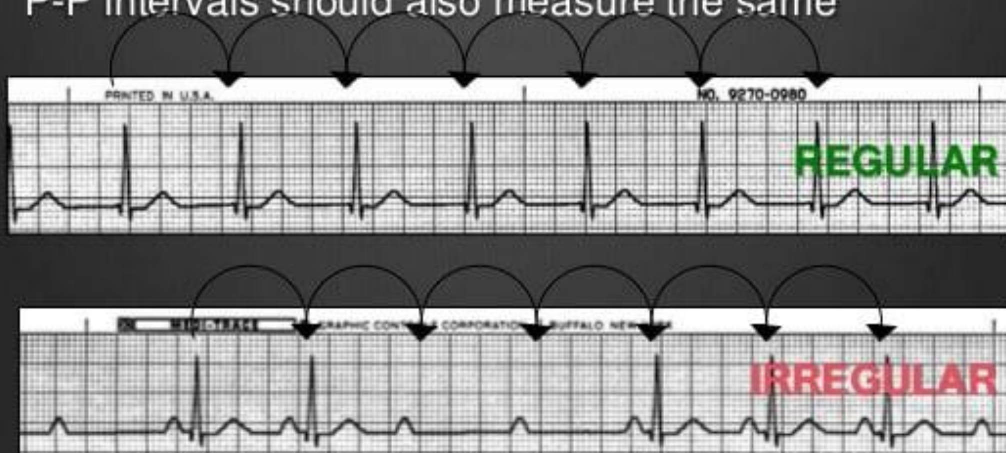
- Tachycardia exists if the rate is greater than 100 bpm.
- Bradycardia exists if the rate is less than 60 bpm.

<u>Method 2</u> :



Step 2 - Rhythm

- Determine if the ventricular rhythm is regular or irregular
- R-R intervals should measure the same
- P-P intervals should also measure the same



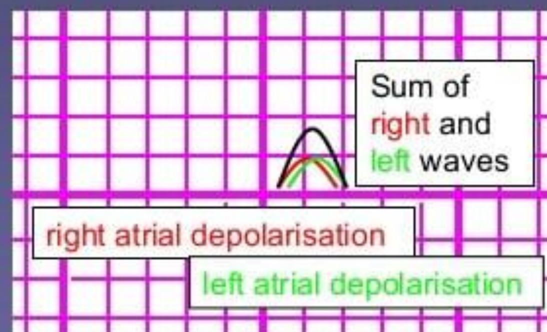
STEP 3 : P Wave Morphology

- Identify and examine P waves:
  - Present?
  - Appearance?
  - Consistency?
  - Relation to QRS?

The P wave

The P wave represents atrial depolarisation

It can be thought of as being made up of two separate waves due to right atrial depolarisation and left atrial depolarisation.



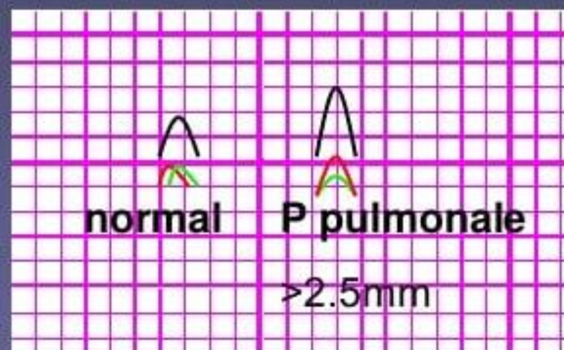
Which occurs first?

Right atrial depolarisation

The P wave

Height

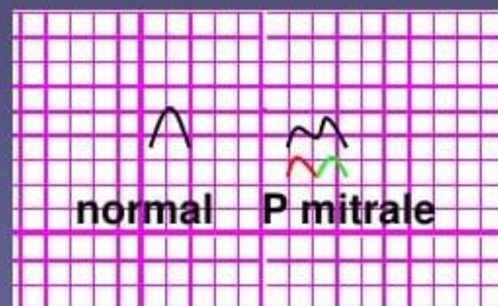
- A tall P wave (over 2.5mm) can be called *P pulmonale*
- Occurs due to **R atrial hypertrophy**
- Causes include:
  - pulmonary hypertension,
  - pulmonary stenosis
  - tricuspid stenosis

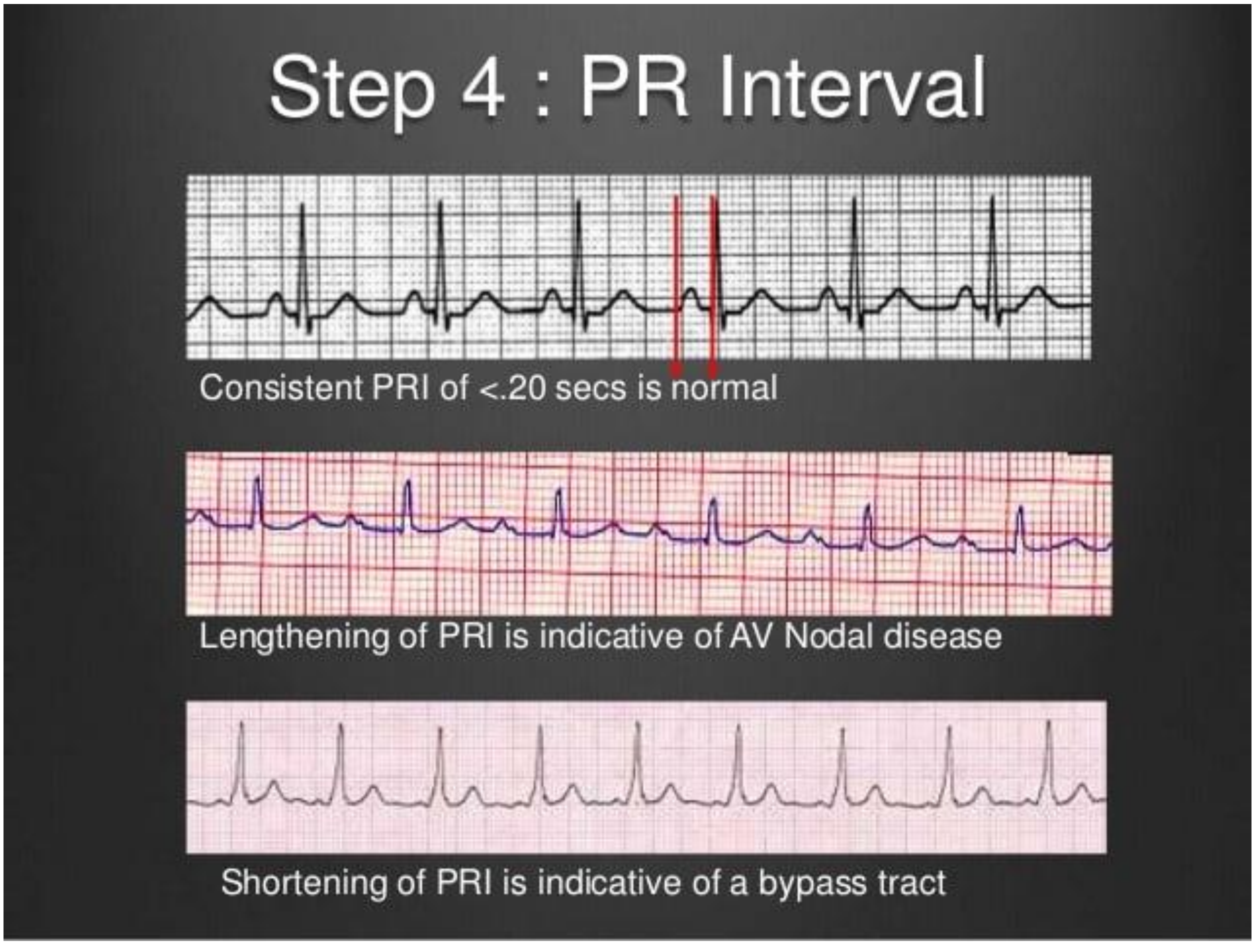


The P wave

Length

- A P wave with a length >0.08 seconds (2 small squares) and a bifid shape is called *P mitrale*
- It is caused by left atrial hypertrophy and delayed left atrial depolarisation
- Causes include:
  - Mitral valve disease
  - LVH




Step 4 : PR Interval
Consistent PRI of <.20 secs is normal
Lengthening of PRI is indicative of AV Nodal disease
Shortening of PRI is indicative of a bypass tract

The PR interval

- The PR interval is measured between the start of the P wave to the start of the QRS complex
- (therefore if there is a Q wave before the R wave the PR interval is measured from the start of the P wave to the start of the *Q* wave, not the start of the R wave)

The PR interval

- If the PR interval is short (less than 3 small squares) it may signify that there is an accessory electrical pathway between the atria and the ventricles, hence the ventricles depolarise early giving a short PR interval.

- One example of this is Wolff-Parkinson-White syndrome where the accessory pathway is called the bundle of Kent. See next slide for an animation to explain this

The PR interval

- If the PR interval is long (>5 small squares or 0.2s):
- If there is a constant long PR interval 1st degree heart block is present
- First degree heart block is a longer than normal delay in conduction at the AV node

The PR interval

- If the PR interval looks as though it is widening every beat and then a QRS complex is missing, there is 2nd degree heart block, Mobitz type I. The lengthening of the PR interval in subsequent beats is known as the Wenckebach phenomenon
- (remember (w)one, Wenckebach, widens)

- If the PR interval is constant but then there is a missed QRS complex then there is 2nd degree heart block, Mobitz type II

The PR interval

- If there is **no discernable relationship** between the P waves and the QRS complexes, then **3rd degree heart** block is present

Step 5 : QRS Duration

- A narrow QRS complex (< 0.12), indicates the impulse has followed the normal conduction pathway

- A widened QRS complex (> 0.12), may indicate the impulse was generated somewhere in the ventricles

QRS width

It is useful to look at leads V_1 and V_6

- LBBB and RBBB can be remembered by the mnemonic:
- **WiLLiaM MaRRoW**
- Bundle branch block is caused either by infarction or fibrosis (related to the ageing process)

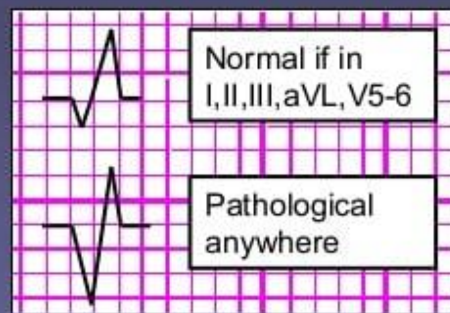
The Q wave

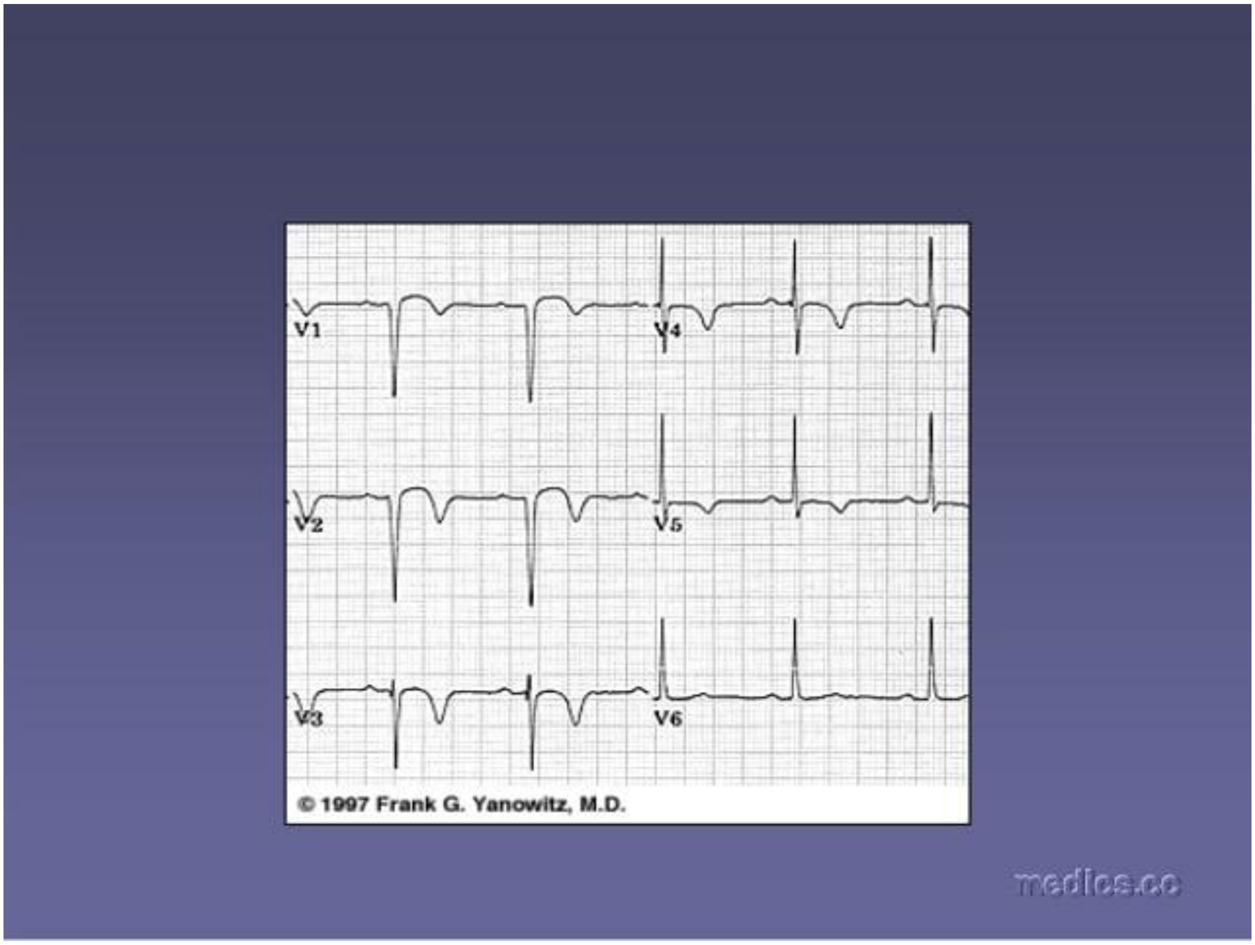
Are there any pathological Q waves?

- A Q wave can be pathological if it is:
  - Deeper than 2 small squares (0.2mV)

  and/or
  - Wider than 1 small square (0.04s)

  and/or
  - In a lead other than III or one of the leads that look at the heart from the left (I, II, aVL, V5 and V6) where small Qs (i.e. not meeting the criteria above) can be normal




V1
V4
V2
V5
V3
V6
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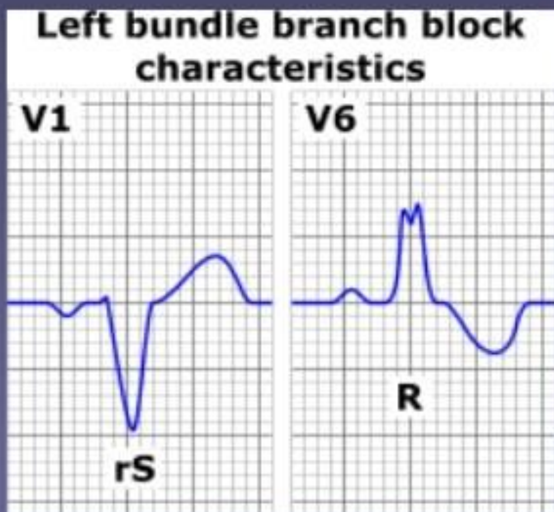
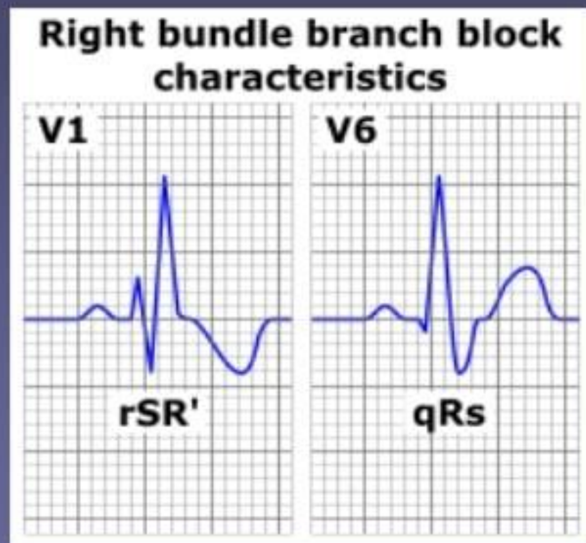
LBBB



- If left bundle branch block is present, the QRS complex may look like a 'W' in V_1 and/or an 'M' shape in V_6.
- New onset LBBB with chest pain consider Myocardial infarction
- Not possible to interpret the ST segment.

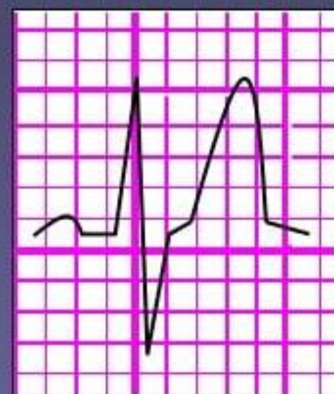
RBBB

- It is also called RSR pattern
- If right bundle branch block is present, there may be an 'M' in V1 and/or a 'W' in V6.
- Can occur in healthy people with normal QRS width – partial RBBB



The T wave

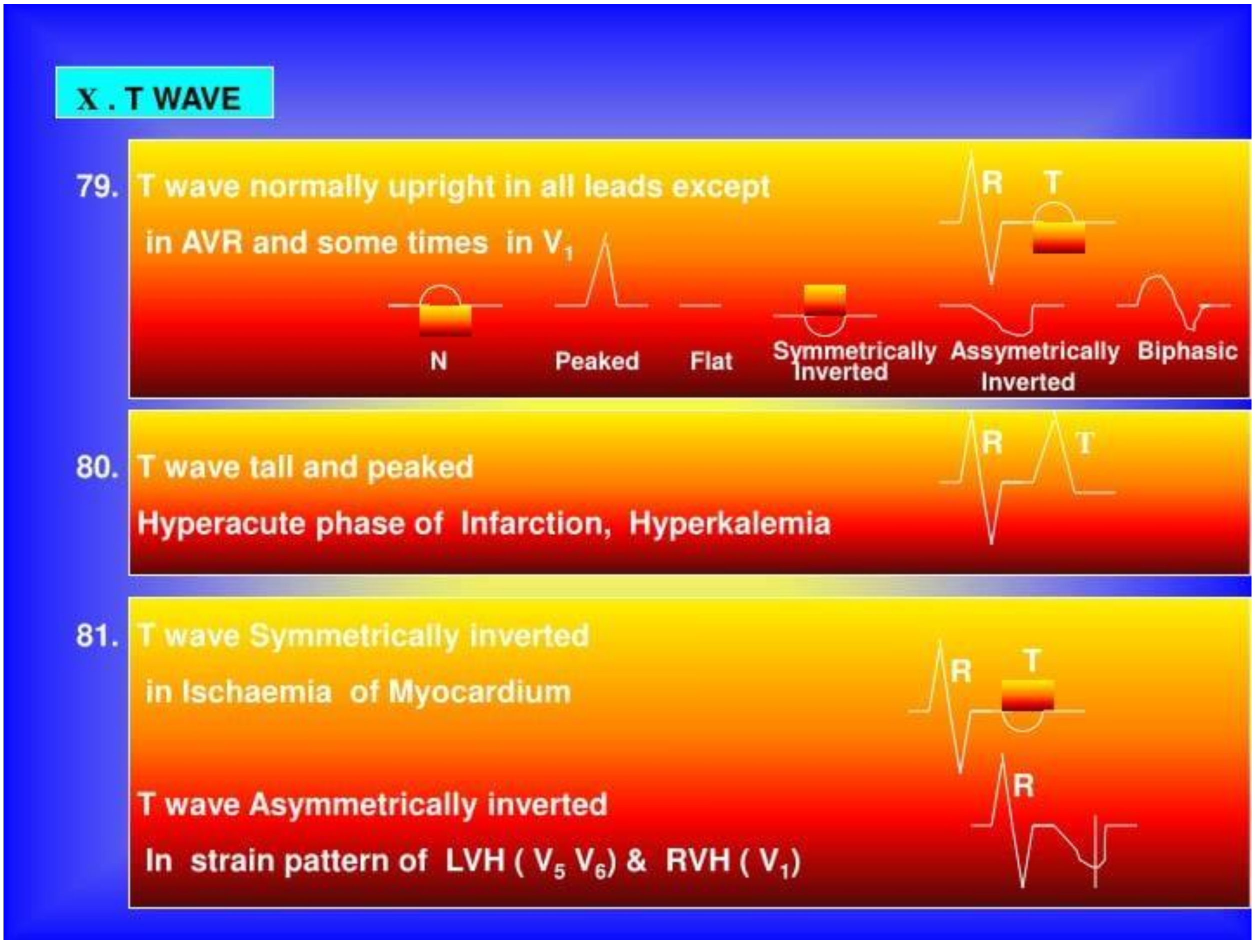
- Are the T waves too tall?
  - No definite rule for height
  - T wave generally shouldn't be taller than half the size of the preceding QRS
  - Causes:
    - Hyperkalaemia
    - Acute myocardial infarction



The T wave

- If the T wave is flat, it may indicate hypokalaemia

- If the T wave is inverted it may indicate ischaemia

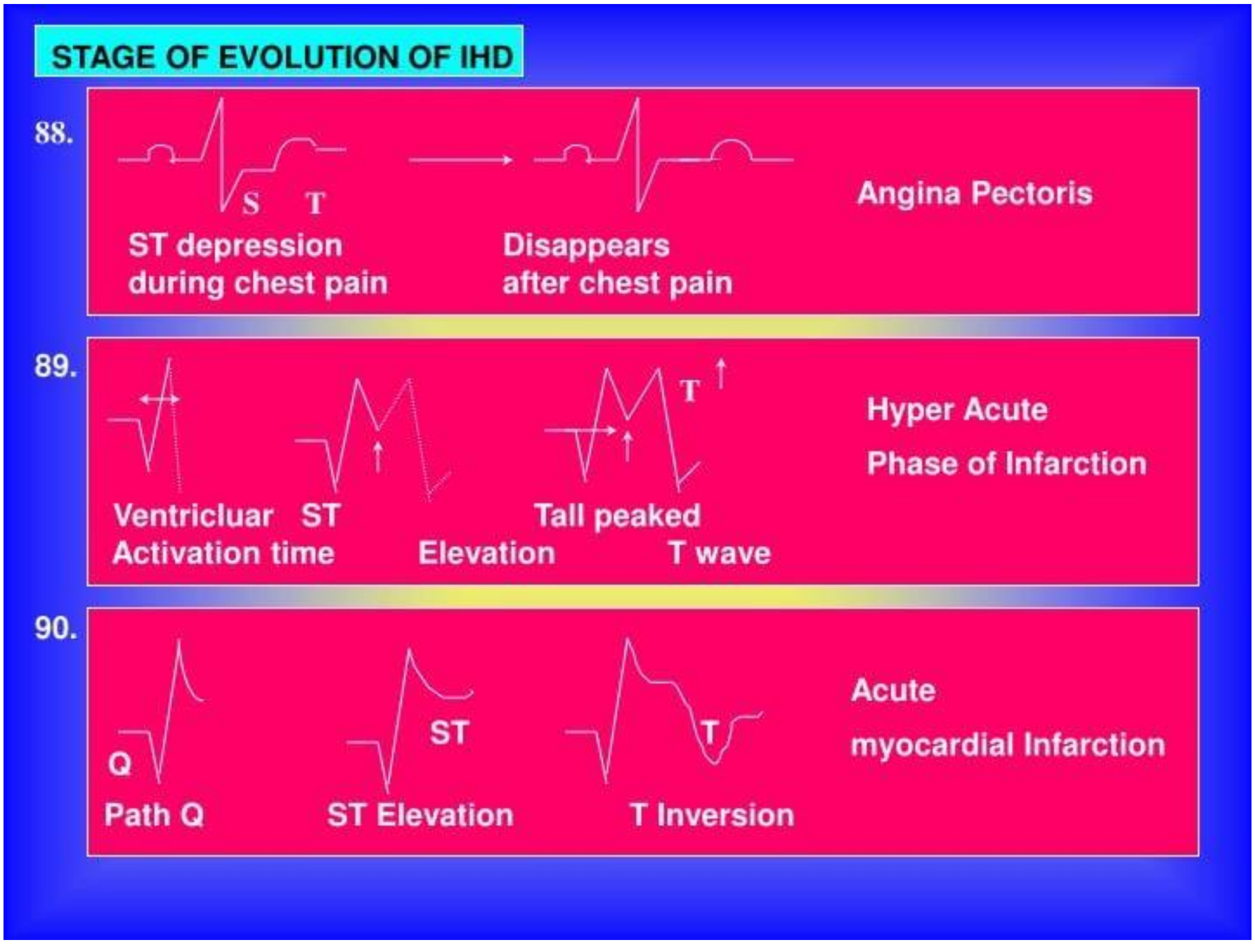

X . T WAVE
79. T wave normally upright in all leads except
in AVR and some times in V_1
R
T
N
Peaked
Flat
Symmetrically Inverted
Assymetrically Inverted
Biphasic
80. T wave tall and peaked
Hyperacute phase of Infarction, Hyperkalemia
R
T
81. T wave Symmetrically inverted
in Ischaemia of Myocardium
R
T
T wave Asymmetrically inverted
In strain pattern of LVH (V_5 V_6) & RVH (V_1)
R

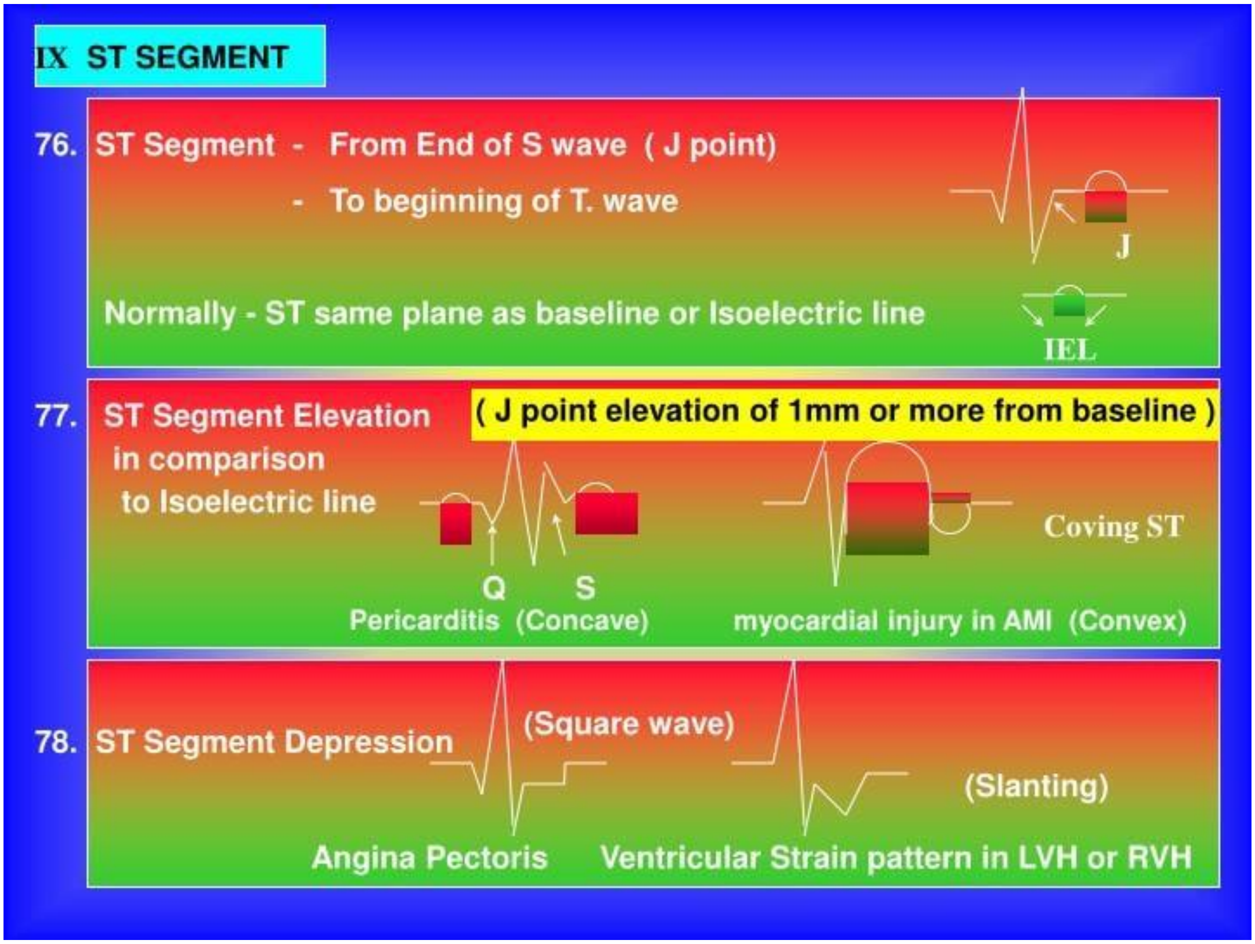
Myocardial infarction

- Within hours:
  - T wave may become peaked
  - ST segment may begin to rise
- Within 24 hours:
  - T wave inverts (may or may not persist)
  - ST elevation begins to resolve
  - If a left ventricular aneurysm forms, ST elevation may persist
- Within a few days:
  - pathological Q waves can form and usually persist

Lead Summary

I Lateral Circumflex Artery	aVR	V1 Septal Left Anterior Descending Artery	V4 Anterior Right Coronary Artery
II Inferior Right Coronary Artery	aVL Lateral Circumflex Artery	V2 Septal Left Anterior Descending Artery	V5 Lateral Circumflex Artery
III Inferior Right Coronary Artery	AVF Inferior Right Coronary Artery	V3 Anterior Right Coronary Artery	V6 Lateral Circumflex Artery


STAGE OF EVOLUTION OF IHD
88.
S
T
ST depression
during chest pain
Disappears
after chest pain
Angina Pectoris
89.
T
Ventricluar ST
Activation time
Elevation
Tall peaked
T wave
Hyper Acute
Phase of Infarction
90.
Q
ST
T
Path Q
ST Elevation
T Inversion
Acute
myocardial Infarction

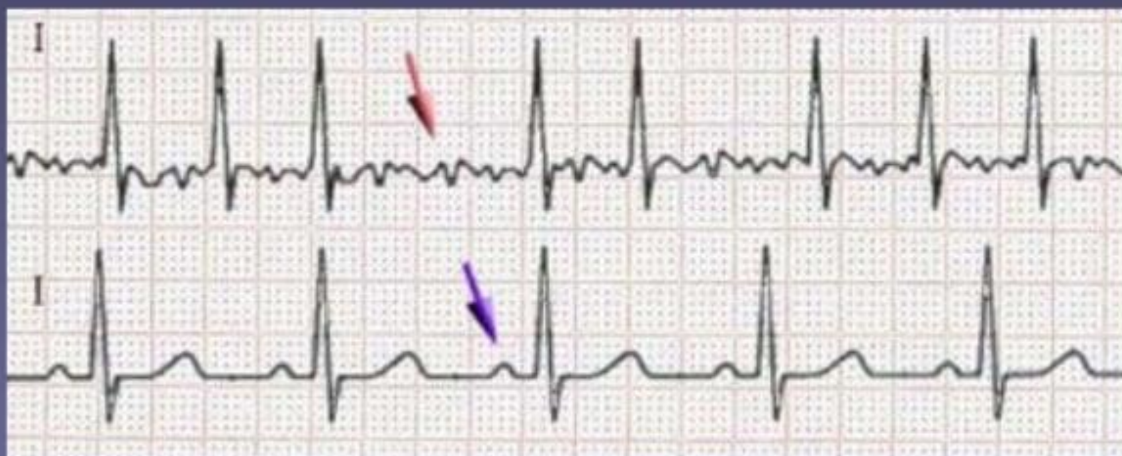

IX ST SEGMENT
76. ST Segment - From End of S wave (J point)
- To beginning of T. wave
J
Normally - ST same plane as baseline or Isoelectric line
IEL
77. ST Segment Elevation in comparison to Isoelectric line
(J point elevation of 1mm or more from baseline)
Q
S
Pericarditis (Concave)
Coving ST
myocardial injury in AMI (Convex)
78. ST Segment Depression
(Square wave)
(Slanting)
Angina Pectoris
Ventricular Strain pattern in LVH or RVH

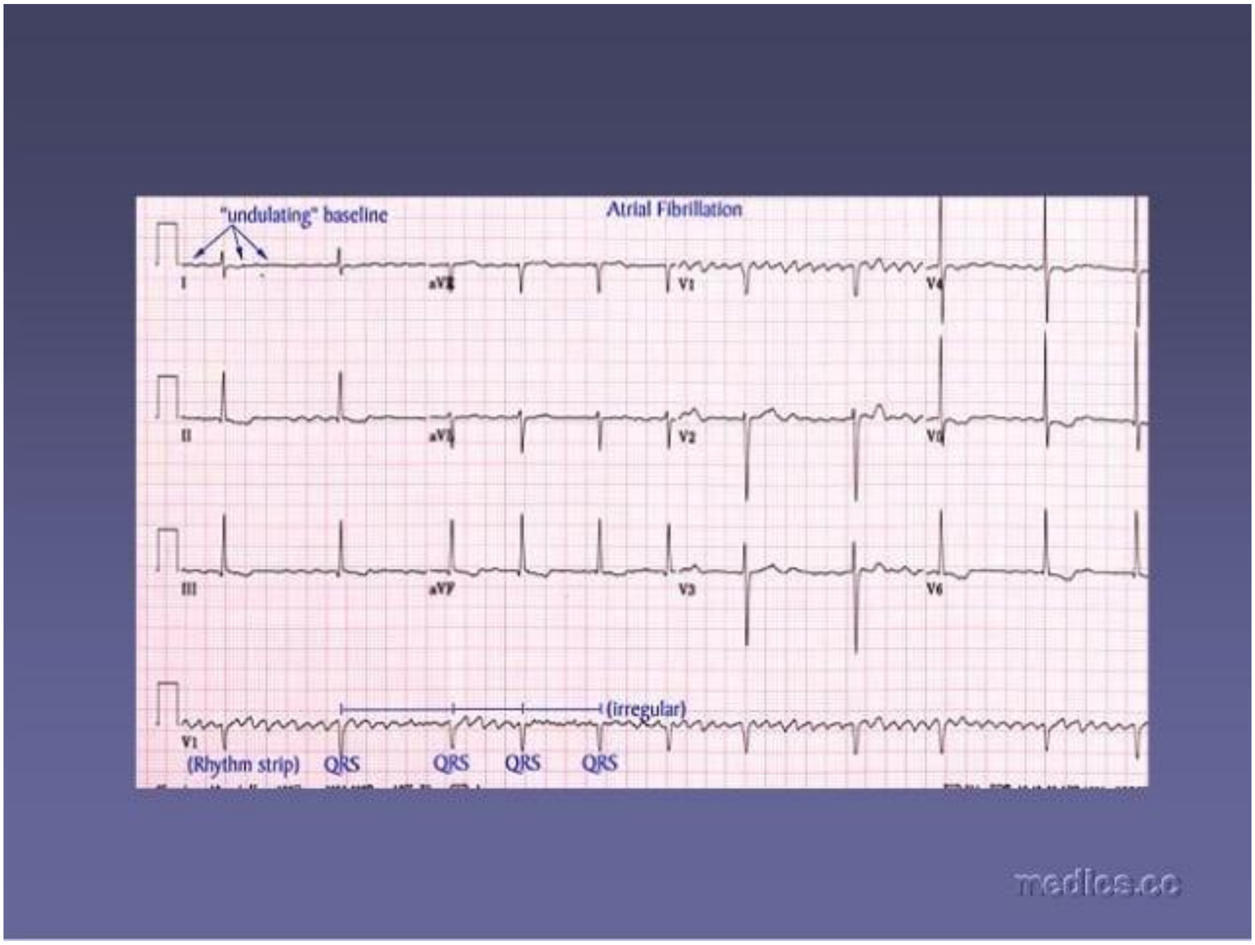
Atrial Fibrillation

Features:

- There maybe tachycardia
- The rhythm is usually irregularly irregular
- No P waves are discernible – instead there is a shaky baseline
  - This is because there is no order to atrial depolarisation, different areas of atrium depolarise at will

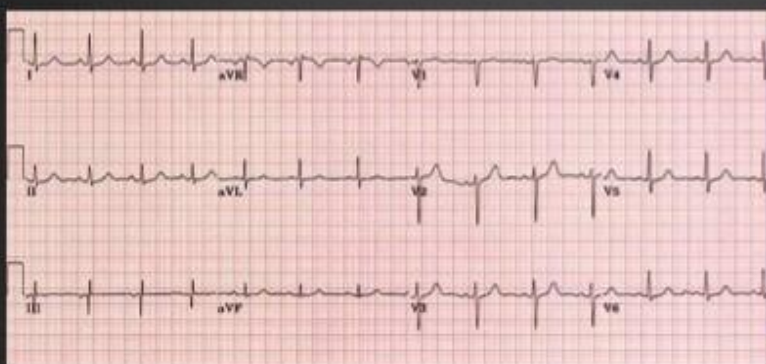
Atrial Fibrillation

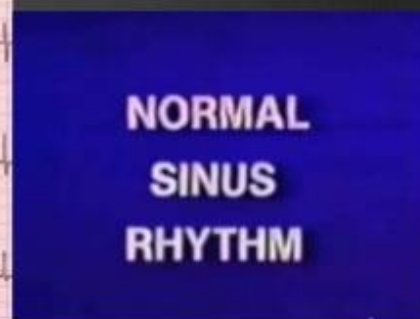



"undulating" baseline
Atrial Fibrillation
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
(irregular)
V1
(Rhythm strip)
QRS
QRS
QRS
QRS
medics.cc

Normal Sinus Rhythm

- 1:1 AV synchrony (one atrial event for each ventricular event)
- Stable rhythm with repeating patterns (60 – 100 bpm)
- Morphologies of beats should be similar from complex to complex
- Rate should be appropriate—not too fast, not too slow



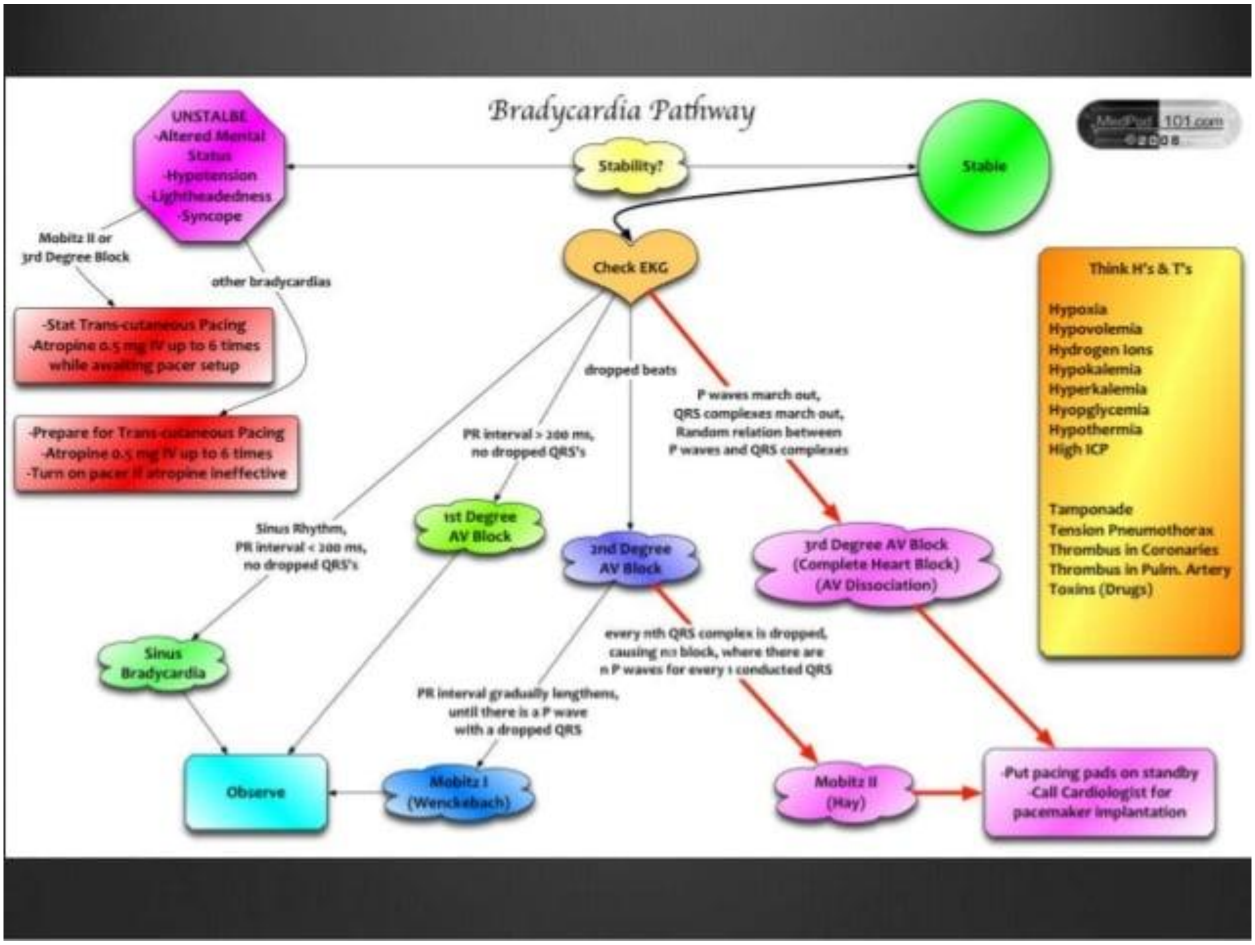


12 lead tracing source : http://meds.queensu.ca/courses/assets/modules/ts-ecg/Normal_ECG.bmp

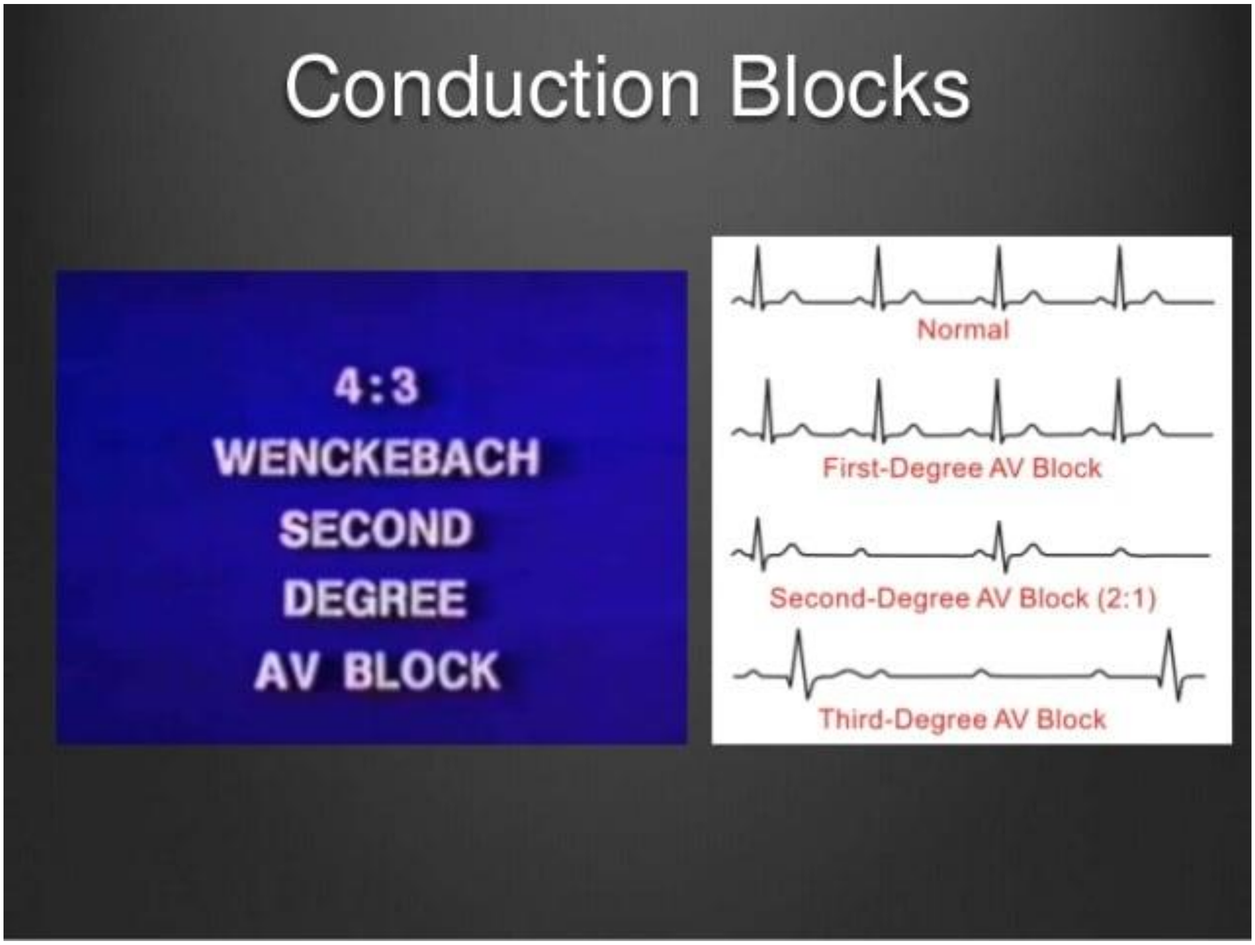
Video source : Youtube.com

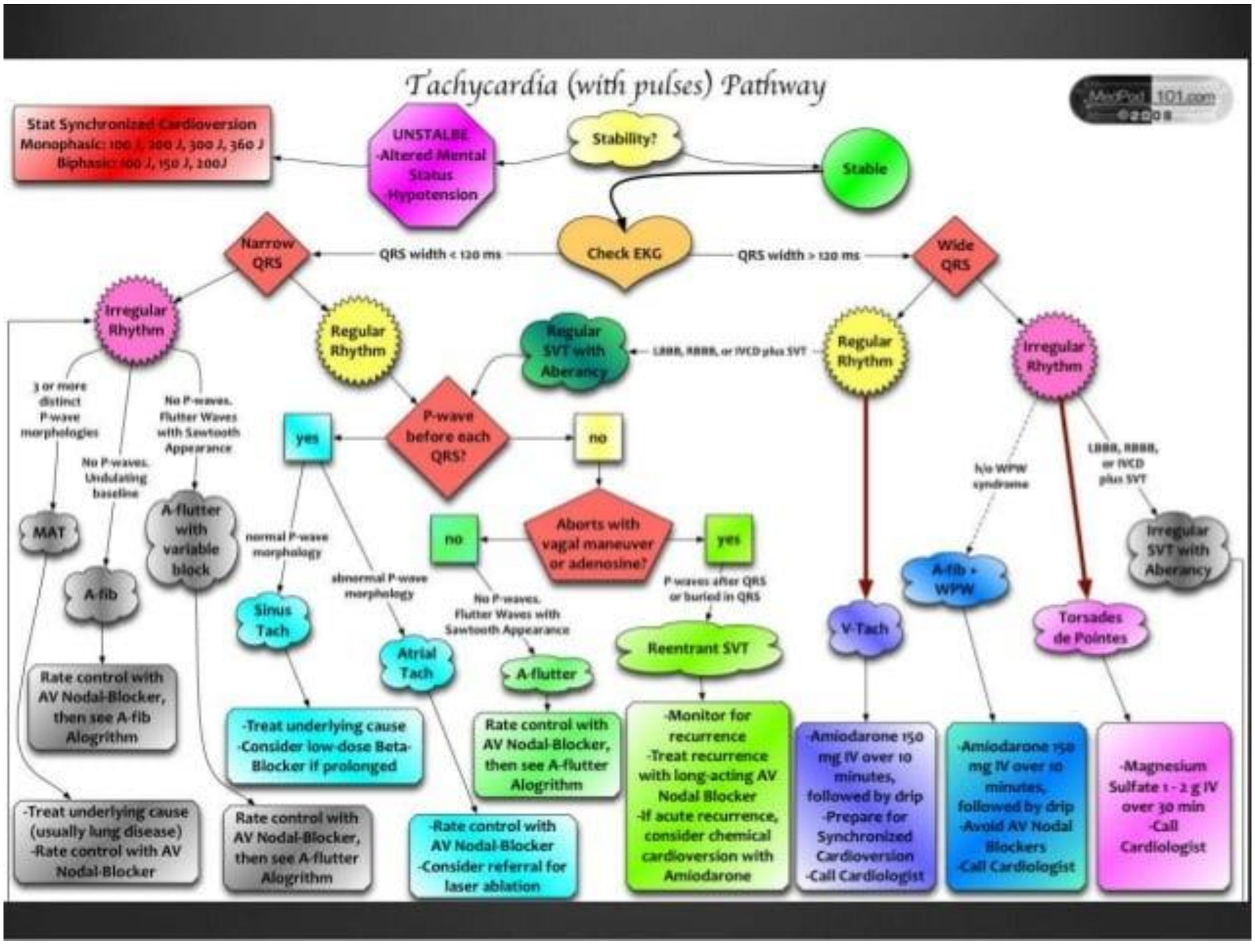
Abnormal Cardiac Rhythm

- Abnormally shaped waves
- Lack of 1:1 AV synchrony
- Rapid cardiac activity, even if otherwise stable
- Very slow cardiac activity, even if otherwise stable
- Irregular cardiac activity
- Variability in PR interval
- Pauses
- Premature beats (oddly timed events)



Bradycardia Pathway
MedPod101.com ©2008
UNSTALBE
-Altered Mental Status
-Hypotension
-Lightheadedness
-Syncope
Stability?
Stable
Check EKG
Mobitz II or 3rd Degree Block
other bradycardias
-Stat Trans-cutaneous Pacing
-Atropine 0.5 mg IV up to 6 times while awaiting pacer setup
-Prepare for Trans-cutaneous Pacing
-Atropine 0.5 mg IV up to 6 times
-Turn on pacer if atropine ineffective
Think H's & T's
Hypoxia
Hypovolemia
Hydrogen Ions
Hypokalemia
Hyperkalemia
Hyopglycemia
Hypothermia
High ICP
Tamponade
Tension Pneumothorax
Thrombus in Coronaries
Thrombus in Pulm. Artery
Toxins (Drugs)
dropped beats
P waves march out, QRS complexes march out, Random relation between P waves and QRS complexes
PR interval > 200 ms, no dropped QRS's
Sinus Rhythm, PR interval < 200 ms, no dropped QRS's
1st Degree AV Block
2nd Degree AV Block
3rd Degree AV Block (Complete Heart Block) (AV Dissociation)
every nth QRS complex is dropped, causing n:1 block, where there are n P waves for every 1 conducted QRS
Sinus Bradycardia
PR interval gradually lengthens, until there is a P wave with a dropped QRS
Observe
Mobitz I (Wenckebach)
Mobitz II (Hay)
-Put pacing pads on standby
-Call Cardiologist for pacemaker implantation


Conduction Blocks
4:3
WENCKEBACH
SECOND
DEGREE
AV BLOCK
Normal
First-Degree AV Block
Second-Degree AV Block (2:1)
Third-Degree AV Block



Tachycardia (with pulses) Pathway
MedPod101.com
Stability?
UNSTALBE
-Altered Mental Status
-Hypotension
Stat Synchronized Cardioversion
Monophasic: 100 J, 200 J, 300 J, 360 J
Biphasic: 100 J, 150 J, 200J
Stable
Check EKG
QRS width < 120 ms
QRS width > 120 ms
Narrow QRS
Wide QRS
Irregular Rhythm
Regular Rhythm
3 or more distinct P-wave morphologies
No P-waves. Undulating baseline
No P-waves. Flutter Waves with Sawtooth Appearance
MAT
A-fib
A-flutter with variable block
Rate control with AV Nodal-Blocker, then see A-fib Alogrithm
-Treat underlying cause (usually lung disease)
-Rate control with AV Nodal-Blocker
Rate control with AV Nodal-Blocker, then see A-flutter Alogrithm
Regular SVT with Aberancy
LBBB, RBBB, or IVCD plus SVT
P-wave before each QRS?
yes
no
normal P-wave morphology
abnormal P-wave morphology
Sinus Tach
Atrial Tach
-Treat underlying cause
-Consider low-dose Beta-Blocker if prolonged
-Rate control with AV Nodal-Blocker
-Consider referral for laser ablation
Aborts with vagal maneuver or adenosine?
no
yes
No P-waves. Flutter Waves with Sawtooth Appearance
A-flutter
Rate control with AV Nodal-Blocker, then see A-flutter Alogrithm
P waves after QRS or buried in QRS
Reentrant SVT
-Monitor for recurrence
-Treat recurrence with long-acting AV Nodal Blocker
-If acute recurrence, consider chemical cardioversion with Amiodarone
Regular Rhythm
V-Tach
-Amiodarone 150 mg IV over 10 minutes, followed by drip
-Prepare for Synchronized Cardioversion
-Call Cardiologist
Irregular Rhythm
h/o WPW syndrome
A-fib + WPW
-Amiodarone 150 mg IV over 10 minutes, followed by drip
-Avoid AV Nodal Blockers
-Call Cardiologist
Torsades de Pointes
-Magnesium Sulfate 1 - 2 g IV over 30 min
-Call Cardiologist
LBBB, RBBB, or IVCD plus SVT
Irregular SVT with Aberancy

Mechanism of Arrhythmia

- Abnormal heart pulse formation
  - Sinus pulse
  - Ectopic pulse
  - Triggered activity
- Abnormal heart pulse conduction
  - Reentry
  - Conduct block

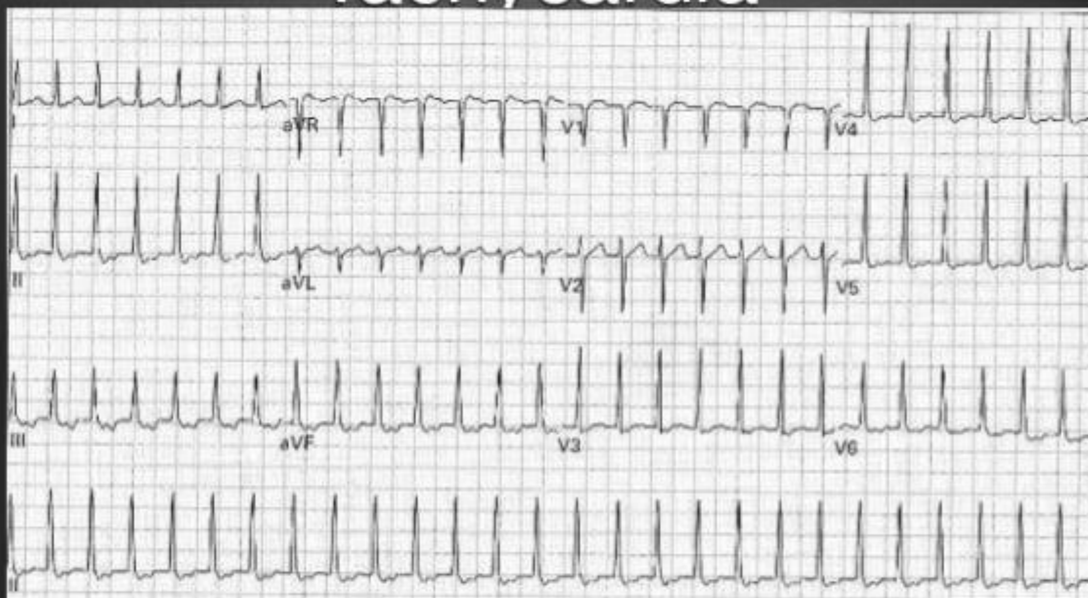
Supraventricular Tachycardia

- Arrhythmia originates “above the ventricles”
  - Usually has a rapid Narrow QRS (ventricular) response
  - Aberrant (abnormal appearing) conduction (SVTAC) can produce a wide-complex tachycardia that may mimic ventricular tachycardia (VT).
- To differentiate SVTs from true VTs
  - If atrial rate>ventricular rate, the rhythm is likely to be an SVT
  - If atrial rate=ventricular rate, the rhythm is likely to be a sinus tachycardia or nodal reentry
  - If the atrial rate<ventricular rate, the rhythm is likely to be a VT

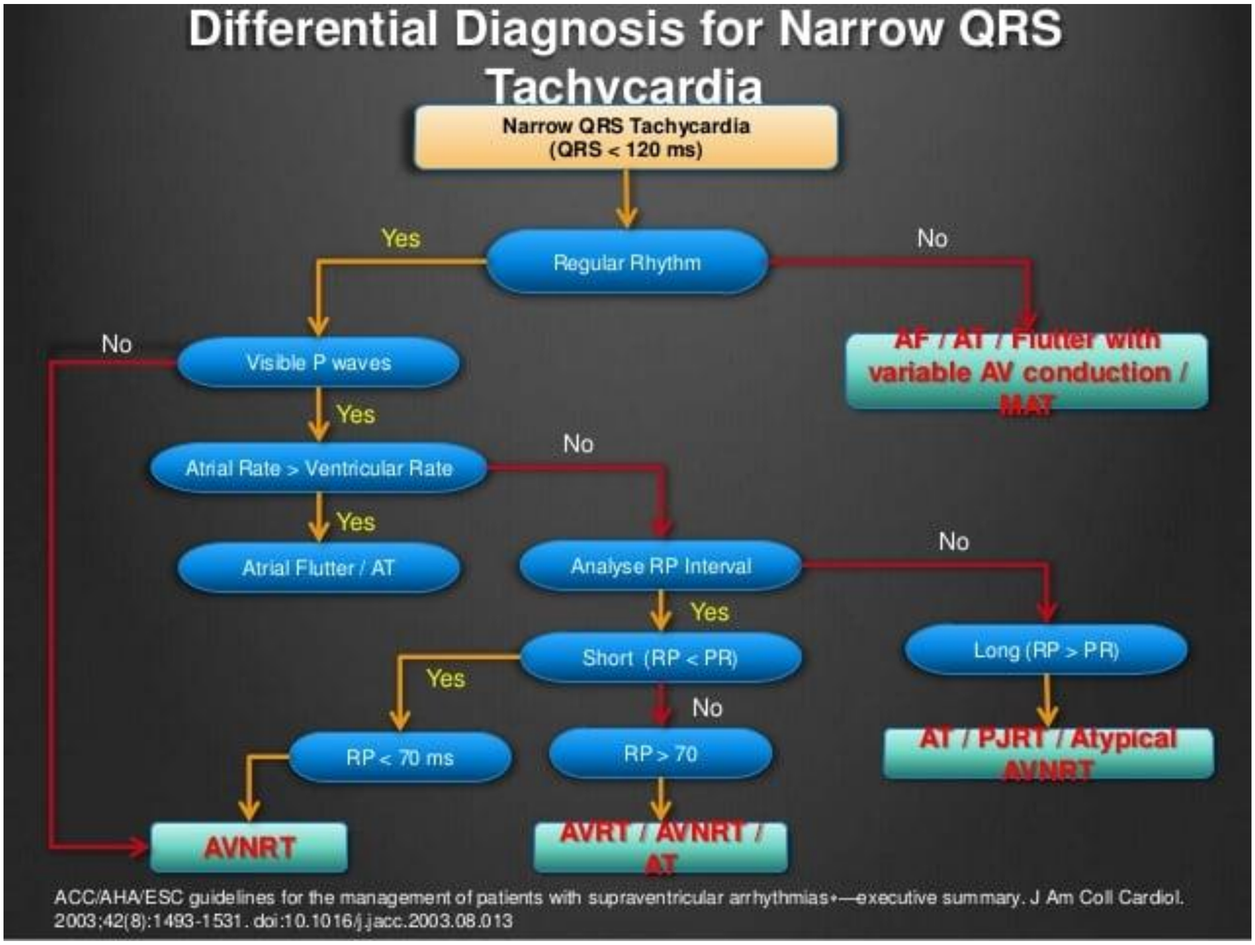
Common Forms of SVT

- **SVTs from a sinoatrial source:**
  - Sinoatrial nodal reentrant tachycardia (SNRT)
- **SVTs from an atrial source:**
  - Ectopic (unifocal) atrial tachycardia (EAT)
  - Multifocal atrial tachycardia (MAT)
  - Atrial fibrillation with a rapid ventricular response
  - Atrial flutter with a rapid ventricular response
  - Without rapid ventricular response, fibrillation and flutter are usually not classified as SVT
- **SVTs from an atrioventricular source (junctional tachycardia):**
  - AV nodal reentrant tachycardia (AVNRT) or junctional reciprocating tachycardia (JRT)
  - Permanent (or persistent) junctional reciprocating tachycardia (PJRT), a form of JRT which occurs predominantly in infants and children but can occasionally occur in adults
  - AV reciprocating tachycardia (AVRT) - visible or concealed (including WPW syndrome)
  - Junctional ectopic tachycardia (JET)

Supraventricular Tachycardia

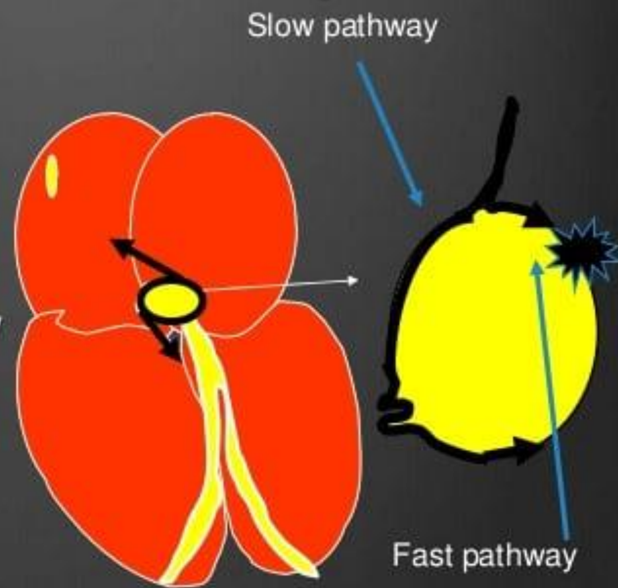


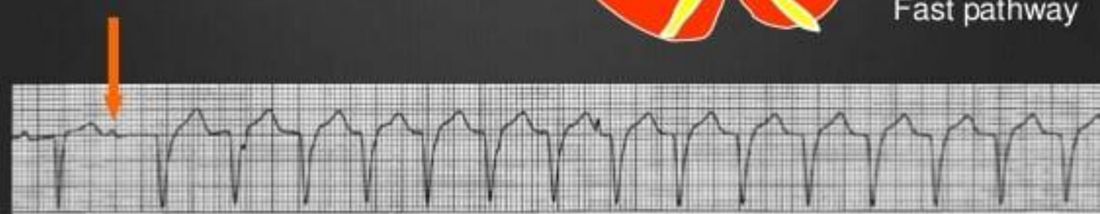
Narrow complex, regular; retrograde P waves, rate <220


Differential Diagnosis for Narrow QRS Tachycardia
Narrow QRS Tachycardia
(QRS < 120 ms)
Regular Rhythm
Yes
No
AF / AT / Flutter with variable AV conduction / MAT
Visible P waves
No
Yes
Atrial Rate > Ventricular Rate
No
Yes
Atrial Flutter / AT
Analyse RP Interval
No
Yes
Short (RP < PR)
Long (RP > PR)
Yes
No
RP < 70 ms
RP > 70
AT / PJRT / Atypical AVNRT
AVNRT
AVRT / AVNRT / AT
ACC/AHA/ESC guidelines for the management of patients with supraventricular arrhythmias*—executive summary. J Am Coll Cardiol. 2003;42(8):1493-1531. doi:10.1016/j.jacc.2003.08.013

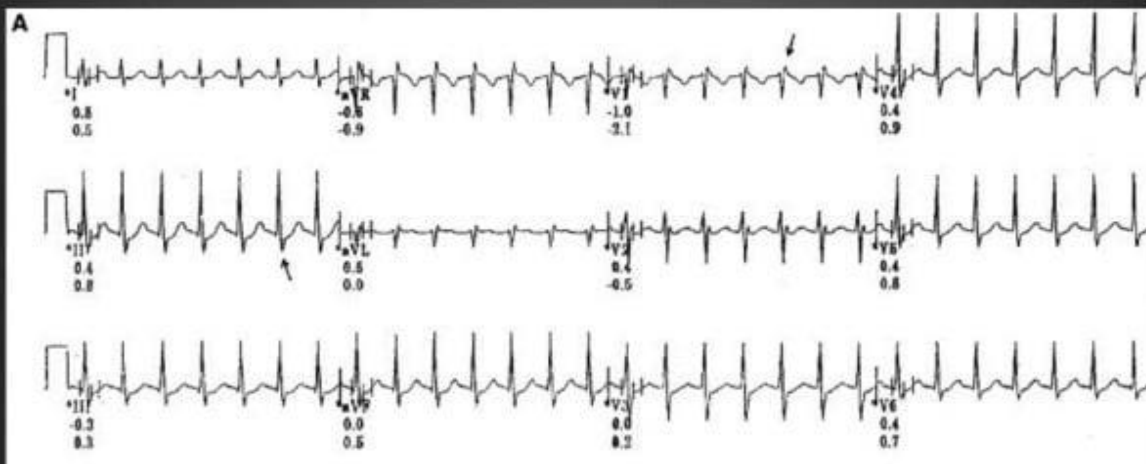
AV Nodal Reentrant Tachycardia

- 2 pathways within or limited to perinodal tissue
    - Anterograde conduction down fast pathway blocks with conduction down slow pathway, with retrograde conduction up fast pathway.





ECG Pattern of Typical AVNRT

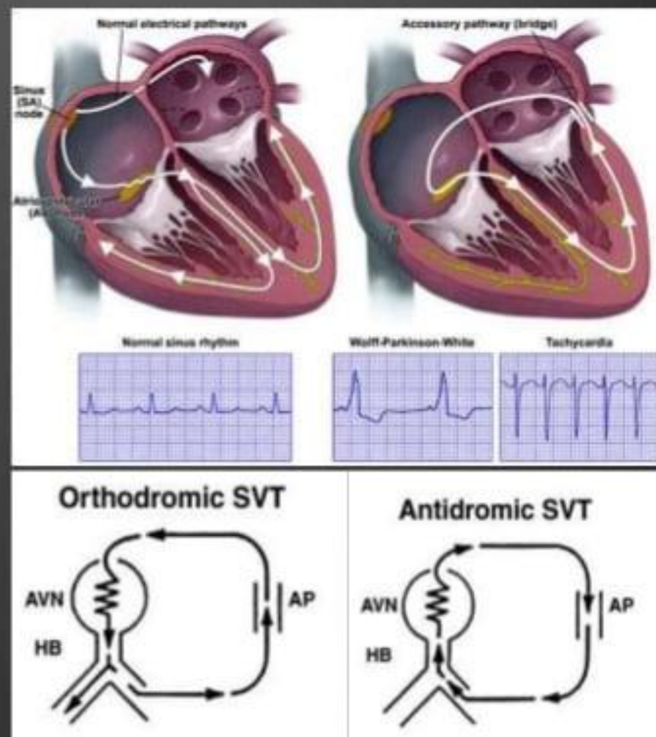


12-Lead ECG shows a regular SVT recorded at an ECG paper speed of 25 mm/sec. Note the pseudo r′ in V_1 (arrow) and accentuated S waves in II, II, aVF (arrow). These findings are pathognomonic for AVNRT.

ACC/AHA/ESC guidelines for the management of patients with supraventricular arrhythmias*—executive summary. J Am Coll Cardiol. 2003;42(8):1493-1531. doi:10.1016/j.jacc.2003.08.013

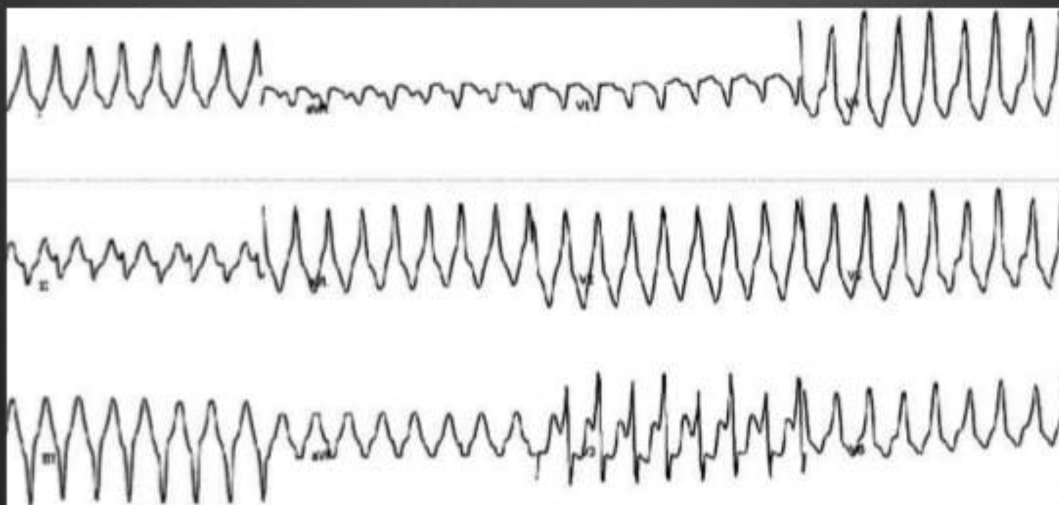
WPW Pathophysiology

- The atrial impulses are conducted partly or completely, prematurely, to the ventricles via a mechanism other than the normal AV-node *



*Moss & Adams

AVRT



- Antidromic atrioventricular reentrant tachycardia,
- Right posteroseptal accessory pathway.
- Note the wide-complex, regular rhythm. The delta waves are more prominent because of maximal pre-excitation.

The 12-Lead Electrocardiogram in Supraventricular Tachycardia. Kumar et al. Cardiol Clin 24 (2006) 427–437

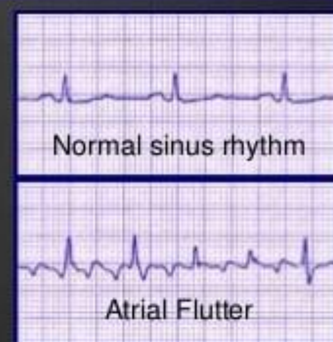
AVRT

- Orthodromic atrioventricular reentrant tachycardia.
- Note the narrow, regular, rapid tachycardia.
- The P waves buried in the ST segment (short-RP interval) are marked with an arrow.
- No pseudo S/R' waves are seen

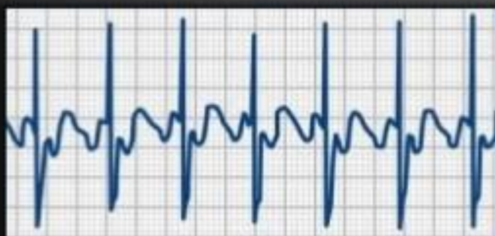
The 12-Lead Electrocardiogram in Supraventricular Tachycardia. Kumar et al. Cardiol Clin 24 (2006) 427–437

Atrial Flutter

- P waves are present but have a characteristic "saw tooth" appearance
- Two types of flutter
  - Type I is organized – i.e., saw tooth appearance
  - Type II is disorganized and appears as a fib/flutter
- Best observed in leads II, III, and aVF.
- Result of reentry within the atria
- Atrial rate is usually range between 220 - 350

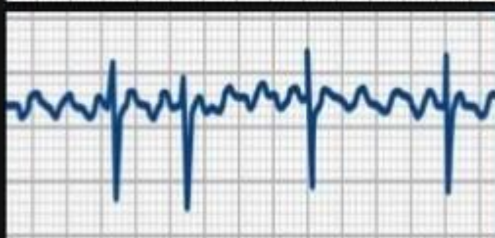


Atrial Flutter



- This atrial flutter shows distinctive atrial beats and the characteristic sawtooth pattern
- Atrial rate here is 250 bpm
- Only every other atrial beat conducts down to the ventricles, so the ventricular rate is 125 bpm

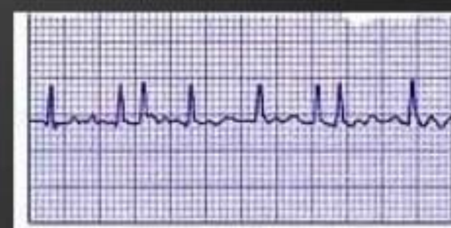
- P-waves are evident
- There are four p-waves to every ventricular beat (4:1 conduction)
- The atrial rate here is 280 bpm



- Atrial flutter with irregular ventricular response
- P-waves are evident; these are "flutter" waves with the characteristic flutter pattern
- Not every P-wave conducts but there is no regular pattern; this indicates AV block

Atrial Fibrillation (AF)

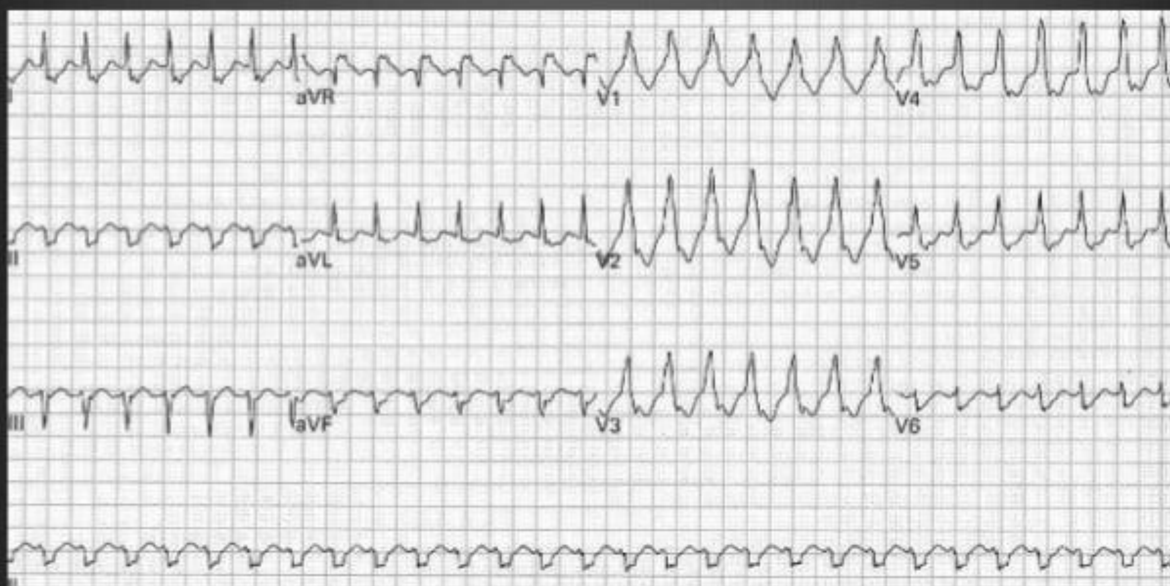
- Disorganized, rapid atrial rhythm
- P-waves not clearly discernible
- Ventricular response is often rapid, may be erratic
- Three main types of AF
  - Paroxysmal
    - Starts suddenly, resolves spontaneously, short episodes, asymptomatic
  - Persistent
    - Longer duration, requires medical intervention, likely symptomatic
  - Permanent
    - Chronic, medically refractory, often severely symptomatic



Ventricular Tachycardia (VT)

A VT is an abnormally fast rhythm that originates within the ventricles, or more specifically in the region below the His bundle.

Ventricular Tachycardia



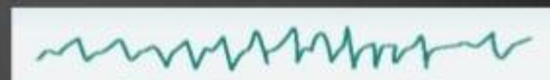
Classification : Etiology

- Ischemic (Post MI)
  - Scar related
  - Slow conduction pathways
  - Re-entry mechanism
- Idiopathic VT
  - Not associated with any SHD – unknown cause
  - Usually Focal mechanism
  - Monomorphic
  - RVOT (85%), RV inflow, RV inferior wall
  - LV “outflow tract”
    - LCC, RCC, NCC
    - coronary venous system
  - LV idiopathic VT (verapamil sensitive)
  - Basal LV
  - Papillary muscles

Classification : Morphology & Duration

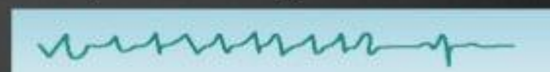
- **Monomorphic** VT - has one QRS shape or morphology

- **Polymorphic** VT - has more than one QRS shape.



Polymorphic nonsustained VT

- **Nonsustained** VT - short bursts of complexes lasting less than 30 seconds.



Nonsustained VT

- **Sustained** VT- complexes lasting at least 30 seconds or that require intervention in less than 30 second

Sustained VT

Distinguishing VT from SVT

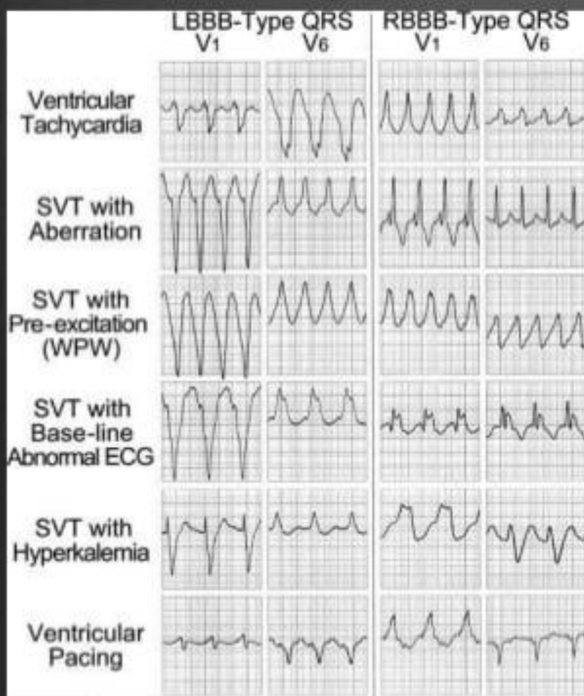
VT	SVT
AV dissociation is present in 50% of patients.	AV dissociation is never present.
Inducible from the ventricle, but not the atrium.	Inducible from the atrium.
QRS duration is often > 140 ms.	QRS duration is often < 140 ms
QRS axis is usually < -30°.	QRS axis is usually > -30°.
No response to adenosine.	Adenosine either restores the sinus rhythm or causes transient rhythm changes.
QRS morphology is atypical for bundle branch block or preexcitation.	QRS morphology may indicate bundle branch block or preexcitation (Delta wave).

Ventricular tachycardia (VT) is diagnosed by demonstrating that the atria are not part of the VT mechanism. Since all VTs are potentially life-threatening, it is critical to distinguish VT from SVT with aberrant conduction.

- AV dissociation is present in 50% of patients with VT. It is never present in SVT. During VT, retrograde conduction over the AV node does not occur. Thus if AV dissociation occurs during extrastimulus pacing but the tachycardia continues, the rhythm is almost always VT (Murgatroyd 2002).
- The table provides information for distinguishing VT from SVT with aberrancy.

More than 95% of patients with previous myocardial infarction and wide-complex QRS have VT regardless of symptoms (Fogoros 1999).

QRS Complexes in different types of WCT

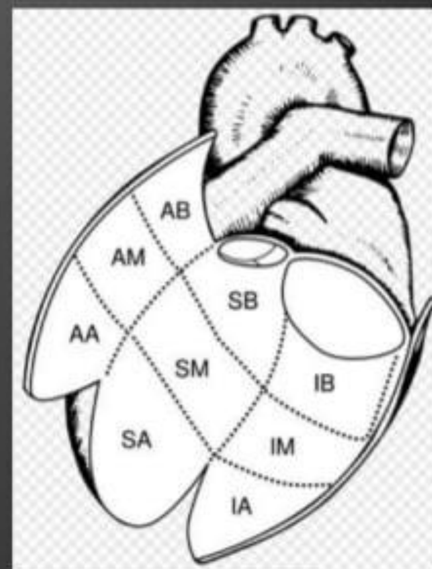


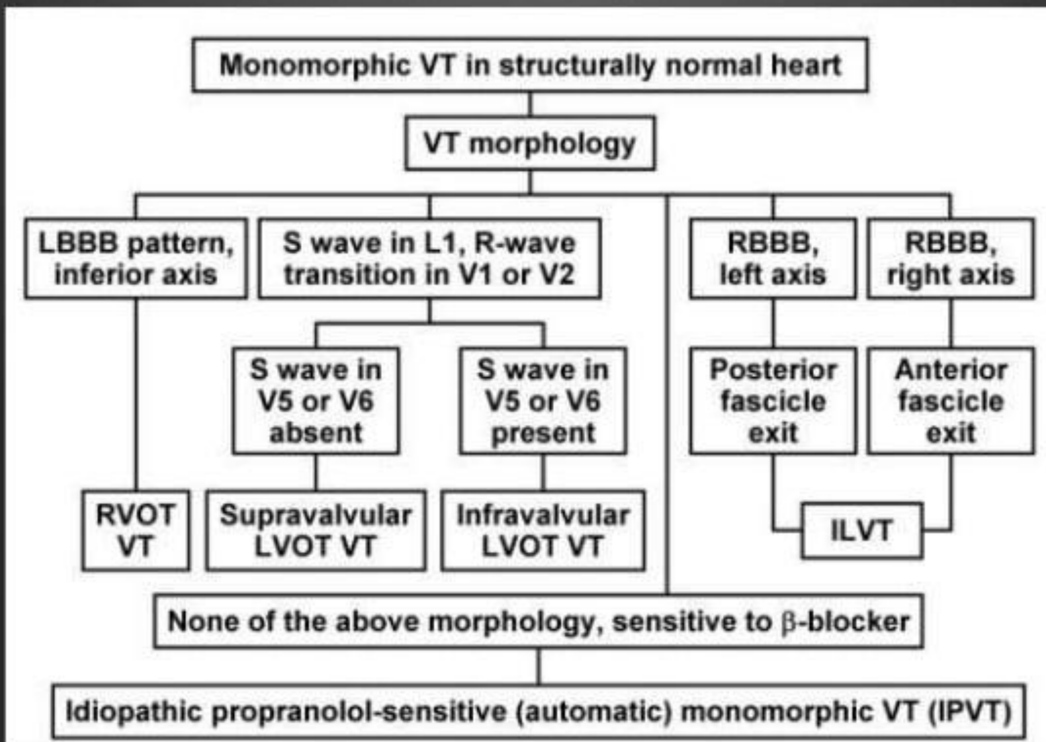
Examples of leads V1 and V6 in both left bundle branch block and right bundle branch block types of QRS complexes in different types of wide complex tachycardia. ECG, electrocardiogram; SVT, supraventricular tachycardia; WPW, Wolff–Parkinson–White syndrome.

Cara N. Pellegrini, Melvin M. Scheinman, Clinical Management of Ventricular Tachycardia, Current Problems in Cardiology, Volume 35, Issue 9, September 2010

VT Localisation

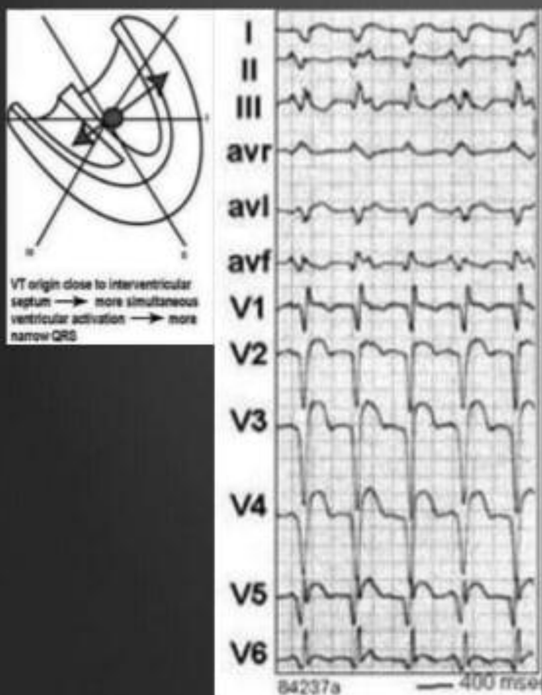
- The steps to finding the exit site are:
  - What is the bundle branch block (BBB) configuration?
  - What is the inferior lead QRS complex polarity?
  - What is the lead I QRS complex polarity?
  - What is the lead aVL QRS complex polarity?
  - What is the lead aVR QRS complex polarity?
  - Where is the R-wave transition point?

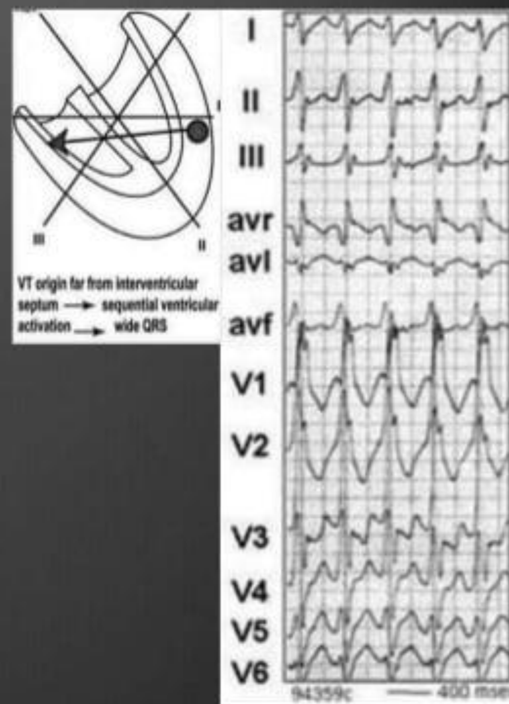




Ventricular Tachycardia in the Absence of Structural Heart Disease. Srivathsan K, Lester SJ, Appleton CP, Scott LR, Munger TM - Indian Pacing Electrophysiol J (2005)

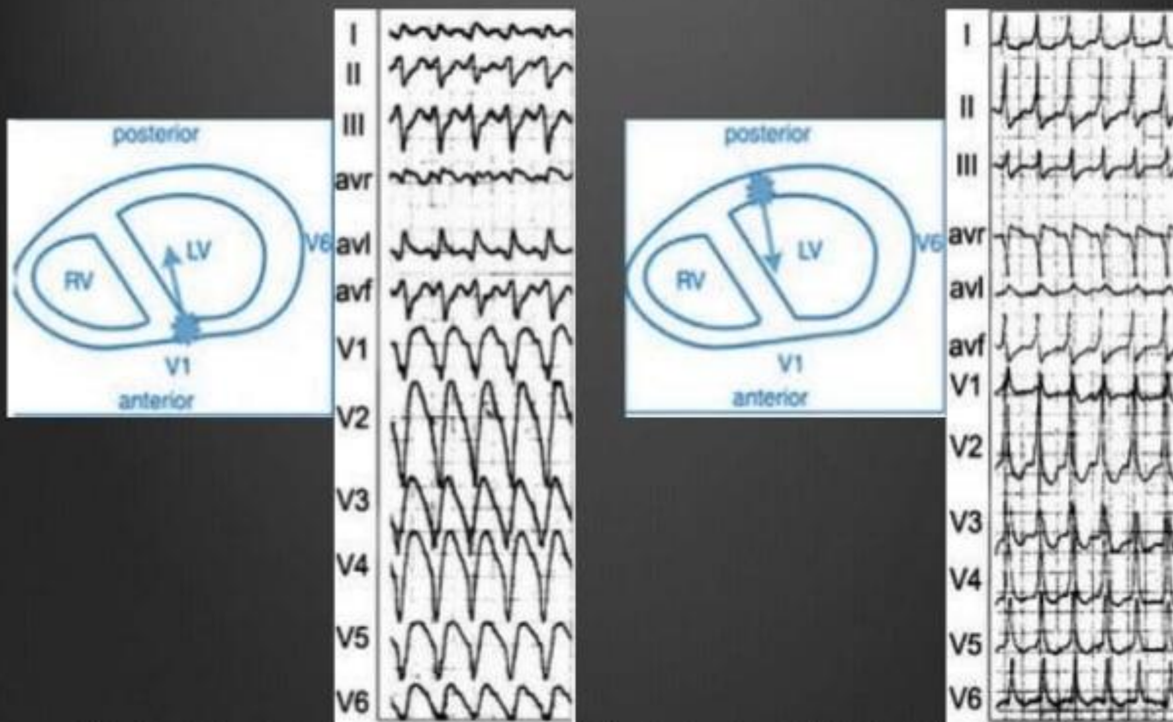
Localization of VT





Using the twelve-lead electrocardiogram to localize the site of origin of ventricular tachycardia. Mark E. Josephson, MD,a David J. Callans, MDb

Localization of VT



Using the twelve-lead electrocardiogram to localize the site of origin of ventricular tachycardia. Mark E. Josephson, MD,a David J. Callans, MDb